

**Report 10738
1 April 1996**

**METSAT
Advanced Microwave Sounding Unit -A1 (AMSU-A1)
Structural Mathematical Model**

**Contract No: NAS 5-32314
CDRL: 102b**

Submitted to:

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

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TABLE OF CONTENTS

Section		Page
1	INTRODUCTION.....	1
1.1	IDENTIFICATION.....	1
1.2	PURPOSE AND OBJECTIVES	1
1.3	DOCUMENT STATUS AND SCHEDULE.....	1
2	REFERENCE DOCUMENTS	2
3	MODEL DESCRIPTION	3
3.1	FINITE ELEMENT MODEL.....	3
3.2	BOUNDARY CONDITIONS.....	4

TABLES

Tables		Page
I	Concentrated Mass Elements (COMN2).....	6
II	Material Properties.....	9

FIGURES

Figure		Page
1	METSAT AMSU-A1 1331552-1 Sidemount Mounting Bolt Grids.....	5

APPENDIX A FIGURES

Figures		Page
A	APPENDIX A.....	A-1
A1a	METSAT AMSU-A1 1331720-1 Mesh Only.....	A-2
A1b	METSAT AMSU-A1 1331720-1 Mesh Only.....	A-3
A1c	METSAT AMSU-A1 1331720-1 Mesh Only.....	A-4
A1d	METSAT AMSU-A1 1331720-1 Mesh Only.....	A-5
A-2	METSAT AMSU-A1 1331505-1 Lower Baseplate Mesh Only	A-6
A-3	METSAT AMSU-A1 1331404-1 Lower Baseplate Grid Points.....	A-7
A-4	METSAT AMSU-A1 1331404-1 Lower Baseplate Shell Elements	A-8
A-5	METSAT AMSU-A1 1331404-1 Lower Baseplate Beam Elements	A-9
A-6	METSAT AMSU-A1 1331414-1-1 Lower Motor Mount Panel Mesh Only.....	A-10
A-7	METSAT AMSU-A1 1331414-1-1 Lower Motor Mount Panel Grid Points	A-11
A-8	METSAT AMSU-A1 1331414-1-1 Lower Motor Mount Panel Shell Elements.....	A-12
A-9	METSAT AMSU-A1 1331414-1-1 Lower Motor Mount Panel Beam Elements.....	A-13
A-10	METSAT AMSU-A1 1331389-1 Upper Motor Mount Panel Mesh Only	A-14
A-11	METSAT AMSU-A1 1331389-1 Upper Motor Mount Panel Grid Points.....	A-15
A-12	METSAT AMSU-A1 1331389-1 Upper Motor Mount Panel Shell Elements	A-16
A-13	METSAT AMSU-A1 1331389-1 Upper Motor Mount Panel Beam Elements	A-17
A-14	METSAT AMSU-A1 1331389-1 Upper Motor Mount Panel Point Elements.....	A-18
A-15	METSAT AMSU-A1 1331401-1 Lower Front Panel Mesh Only	A-19
A-16	METSAT AMSU-A1 1331401-1 Lower Front Panel Grid Points.....	A-20

FIGURES

Figures		Page
A-17	METSAT AMSU-A1 1331401-1 Lower Front Panel Shell Elements	A-21
A-18	METSAT AMSU-A1 1331401-1 Lower Front Panel Beam Elements	A-22
A-19	METSAT AMSU-A1 1331401-1 Lower Front Panel Point Elements	A-23
A-20	METSAT AMSU-A1 1331652-1 Lower Aft Panel Mesh Only	A-24
A-21	METSAT AMSU-A1 1331652-1 Lower Aft Panel Grid Points	A-25
A-22	METSAT AMSU-A1 1331652-1 Lower Aft Panel Shell Elements	A-26
A-23	METSAT AMSU-A1 1331652-1 Lower Aft Panel Beam Elements	A-27
A-24	METSAT AMSU-A1 1331356-3-1 Upper Baseplate Mesh Only	A-28
A-25	METSAT AMSU-A1 1331356-3-1 Upper Baseplate Grid Points	A-29
A-26	METSAT AMSU-A1 1331356-3-1 Upper Baseplate Shell Elements	A-30
A-27	METSAT AMSU-A1 1331356-3-1 Upper Baseplate Beam Elements	A-31
A-28	METSAT AMSU-A1 1331356-3-1 Upper Baseplate Point Elements & MPCS	A-32
A-29	METSAT AMSU-A1 1331352-3 Upper Front Panel Mesh Only	A-33
A-30	METSAT AMSU-A1 1331352-3 Upper Front Panel Grid Points	A-34
A-31	METSAT AMSU-A1 1331352-3 Upper Front Panel Shell Elements	A-35
A-32	METSAT AMSU-A1 1331352-3 Upper Front Panel Beam Elements	A-36
A-33	METSAT AMSU-A1 1331352-3 Upper Front Panel Point Elements	A-37
A-34	METSAT AMSU-A1 1331642-3 Upper Aft Panel Mesh Only	A-38
A-35	METSAT AMSU-A1 1331642-3 Upper Aft Panel Grid Points	A-39
A-36	METSAT AMSU-A1 1331642-3 Upper Aft Panel Shell Elements	A-40
A-37	METSAT AMSU-A1 1331642-3 Upper Aft Panel Beam Elements	A-41
A-38	METSAT AMSU-A1 1331642-3 Upper Aft Panel Point Elements	A-42
A-39	METSAT AMSU-A1 1356429-1 A1-1 Receiver Assembly Mesh Only	A-43
A-40	METSAT AMSU-A1 1356429-1 A1-1 Receiver Assembly Grid Points	A-44
A-41	METSAT AMSU-A1 1356429-1 A1-1 Receiver Assembly Shell Elements	A-45
A-42	METSAT AMSU-A1 1356429-1 A1-1 Receiver Assembly Beam Elements	A-46
A-43	METSAT AMSU-A1 1356429-1 A1-1 Receiver Assembly Point Elements & MPCS	A-47
A-44	METSAT AMSU-A1 1356409-1 A1-2 Receiver Assembly Mesh Only	A-48
A-45	METSAT AMSU-A1 1356409-1 Receiver Assembly Point Elements	A-49
A-46	METSAT AMSU-A1 1356409-1 Receiver Assembly Grid Points	A-50
A-47	METSAT AMSU-A1 1356409-1 Receiver Assembly Shell Elements	A-51
A-48	METSAT AMSU-A1 1356409-1 Receiver Assembly Beam Elements	A-52
A-49	METSAT AMSU-A1 1331447-1 Lower Right Front Support - Grids, Shells, & Beams	A-53
A-50	METSAT AMSU-A1 1331650-1 Lower Right Panel Mesh only	A-54
A-51	METSAT AMSU-A1 1331650-1 Lower Right Panel - Grid Points	A-55
A-52	METSAT AMSU-A1 1331650-1 Lower Right Panel - Shell Elements	A-56
A-53	METSAT AMSU-A1 1331650-1 Lower Right Panel - Beam Elements	A-57
A-54	METSAT AMSU-A1 1331390-1 Upper Right Front Support - Grids, Shells, & Beams	A-58
A-55	METSAT AMSU-A1 1331651-1 Upper Right Panel Mesh Only	A-59
A-56	METSAT AMSU-A1 1331651-1 Upper Right Panel Grid Points	A-60
A-57	METSAT AMSU-A1 1331651-1 Upper Right Panel Shell Elements	A-61
A-58	METSAT AMSU-A1 1331651-1 Upper Right Panel Beam Elements	A-62
A-59	METSAT AMSU-A1 1331651-1 Upper Right Panel Point Elements	A-63
A-60	METSAT AMSU-A1 1331648-1 Top Panel Mesh Only	A-64
A-61	METSAT AMSU-A1 1331648-1 Top Panel Grid Points	A-65
A-62	METSAT AMSU-A1 1331648-1 Top Panel Shell Elements	A-66
A-63	METSAT AMSU-A1 1331648-1 Top Panel Beam Elements	A-67
A-64	METSAT AMSU-A1 1331640-1 Left Panel (W/Covers) Mesh Only	A-68

FIGURES

Figures		Page
A-65	METSAT AMSU-A1 1331640-1 Left Panel (W/Covers) Grid Points.....	A-69
A-66	METSAT AMSU-A1 1331640-1 Left Panel (W/Covers) Shell Elements	A-70
A-67	METSAT AMSU-A1 1331445-1 Lower Left Shield Grid Points	A-71
A-68	METSAT AMSU-A1 1331405-1 Lower Right Shield Grid Points	A-71
A-69	METSAT AMSU-A1 1331445-1 Lower Left Shield Shell Elements.....	A-72
A-70	METSAT AMSU-A1 1331405-1 Lower Right Shield Shell Elements.....	A-72
A-71	METSAT AMSU-A1 1331445-1 Lower Left Shield Beam Elements	A-73
A-72	METSAT AMSU-A1 1331405-1 Lower Right Shield Beam Elements.....	A-73
A-73	METSAT AMSU-A1 1331647-1 Upper Left Shield Grid Points.....	A-74
A-74	METSAT AMSU-A1 1331646-1 Upper Right Shield Grid Points	A-74
A-75	METSAT AMSU-A1 1331647-1 Upper Left Shield Shell Elements	A-75
A-76	METSAT AMSU-A1 1331646-1 Upper Right Shield Shell Elements.....	A-75
A-77	METSAT AMSU-A1 1331647-1 Upper Left Shield Beam Elements	A-76
A-78	METSAT AMSU-A1 1331646-1 Upper Right Shield Beam Elements.....	A-76
A-79	METSAT AMSU-A1 1331600-2 Lower Card Cage Assembly Mesh Only.....	A-77
A-80	METSAT AMSU-A1 1331600-2 Lower Card Cage Assembly Grid Points	A-78
A-81	METSAT AMSU-A1 1331600-2 Lower Card Cage Assembly Shell Assembly	A-79
A-82	METSAT AMSU-A1 1331600-2 Lower Card Cage Assembly Point Elements & MPCs	A-80
A-83	METSAT AMSU-A1 1331600-1 Lower Card Cage Card 1 Grids & Shells	A-81
A-84	METSAT AMSU-A1 1331600-1 Lower Card Cage Card 2 Grids & Shells	A-82
A-85	METSAT AMSU-A1 1331600-1 Lower Card Cage Card 3 Grids & Shells	A-83
A-86	METSAT AMSU-A1 1331600-1 Lower Card Cage Card 4 Grids & Shells	A-84
A-87	METSAT AMSU-A1 1331162-1 Upper Card Cage Mesh Only	A-85
A-88	METSAT AMSU-A1 1331162-1 Upper Card Cage Grid Points	S-86
A-89	METSAT AMSU-A1 1331162-1 Upper Card Cage Shell Elements.....	A-87
A-90	METSAT AMSU-A1 1331162-1 Upper Card Cage Beam Elements.....	A-88
A-91	METSAT AMSU-A1 1331162-1 Upper Card Cage Point Elements.....	A-89
A-92	METSAT AMSU-A1 1331162-1 Upper Card Cage MPCs	A-90
A-93	METSAT AMSU-A1 1331162-1 Upper Card Cage Card (+X) Grids & Shells	A-91
A-94	METSAT AMSU-A1 1331162-1 Upper Card Cage Card (-X) Grids & Shells	A-92
A-95	METSAT AMSU-A1 1331380-1 Calibration Source-Warmload (Lower) Mesh Only	A-93
A-96	METSAT AMSU-A1 1331380-1 Calibration Source-Warmload (Lower) Grid Points.....	A-94
A-97	METSAT AMSU-A1 Calibration Source-Warmload (Lower) Shell Elements.....	A-95
A-98	METSAT AMSU-A1 Calibration Source-Warmload (Lower) Point Elements	A-96
A-99	METSAT AMSU-A1 1331380-2 Calibration Source-Warmload (Upper) Mesh Only.....	A-97
A-100	METSAT AMSU-A1 1331380-2 Calibration Source-Warmload (Upper) Grid Points.....	A-98
A-101	METSAT AMSU-A1 1331380-2 Calibration Source-Warmload (Upper) Shell Elements	A-99
A-102	METSAT AMSU-A1 1331380-2 Calibration Source-Warmload (Upper) Point Elements	A-100
A-103	METSAT AMSU-A1 1331406-1 Beam Support Grid Points	A-101
A-104	METSAT AMSU-A1 1331406-1 Beam Support Beam Elements.....	A-102
A-105	METSAT AMSU-A1 1355777-1 Lower Reflector Assembly Mesh Only	A-103
A-106	METSAT AMSU-A1 1355777-1 Lower Reflector Assembly Grip Points.....	A-104
A-107	METSAT AMSU-A1 1355777-1 Lower Reflector Assembly Shell Elements	A-105
A-108	METSAT AMSU-A1 1355777-1 Lower Reflector Assembly Beam Elements	A-106
A-109	METSAT AMSU-A1 1355777-1 Lower Reflector Assembly Point Elements.....	A-107
A-110	METSAT AMSU-A1 1356962-1 Power Control/Monitor Assembly Mesh Only	A-108
A-111	METSAT AMSU-A1 Power Control/Monitor - PCB Only - Mesh Only	A-109

FIGURES

Figures	Page
A-112	METSAT AMSU-A1 1356962-1 Power Control/Monitor Assembly Printed Wiring Board Grid Points A-110
A-113	METSAT AMSU-A1 1356962-1 Power Control/Monitor Assembly Printed Wiring Board Shell Elements..... A-111
A-114	METSAT AMSU-A1 1356962-1 Power Control/Monitor Assembly Printed Wiring Board Point Elements..... A-112
A-115	METSAT AMSU-A1 1356962-1 Power Control/Monitor Assembly Standoffs Beam Elements..... A-113
A-116	METSAT AMSU-A1 1356790-1 PCM Connector Bracket Mesh Only A-114
A-117	METSAT AMSU-A1 1356962-1 Bracket Power Control/Monitor Assembly Grid Points..... A-115
A-118	METSAT AMSU-A1 1356962-1 Bracket Power Control/Monitor Assembly Shell Elements A-116
A-119	METSAT AMSU-A1 1356962-1 Bracket Power Control/Monitor Assembly Point Elements..... A-117
A-120	METSAT AMSU-A1 1331511-1 Radiator Panel Mesh Only A-118
A-121	METSAT AMSU-A1 1331511-1 Radiator Panel Grid Points A-119
A-122	METSAT AMSU-A1 1331511-1 Radiator Panel Shell Elements..... A-120
A-123	METSAT AMSU-A1 1331511-1 Radiator Panel Point Elements..... A-121
A-124	METSAT AMSU-A1 1331552-1 Sidemount Assembly Mesh Only A-122
A-125	METSAT AMSU-A1 1331552-1 Sidemount Assembly Mesh Only A-123
A-126	METSAT AMSU-A1 1331552-1 Sidemount Assembly Grid Points..... A-124
A-127	METSAT AMSU-A1 1331552-1 Sidemount Assembly Grid Points..... A-125
A-128	METSAT AMSU-A1 1331552-1 Sidemount Assembly Grid Points..... A-126
A-129	METSAT AMSU-A1 1331552-1 Sidemount Assembly Shell Elements A-127
A-130	METSAT AMSU-A1 1331552-1 Sidemount Assembly Shell Elements A-128
A-131	METSAT AMSU-A1 1331552-1 Sidemount Assembly Shell Elements A-129
A-132	METSAT AMSU-A1 1331552-1 Sidemount Assembly Beam Element..... A-130
A-133	METSAT AMSU-A1 1355777-1 Upper Reflector Assembly Grid Points..... A-131
A-134	METSAT AMSU-A1 1355777-1 Upper Reflector Assembly Grid Points..... A-132
A-135	METSAT AMSU-A1 1355777-1 Upper Reflector Assembly Shell Elements A-133
A-136	METSAT AMSU-A1 1355777-1 Upper Reflector Assembly Beam Elements A-134
A-137	METSAT AMSU-A1 1355777-1 Upper Reflector Assembly Point Elements A-135

SECTION 1

INTRODUCTION

This Structural Math Model for the Meteorological Satellites Project (METSAT) Advanced Microwave Sounding Units - A (AMSU-A), A1 Module, provides the description for the NASTRAN finite element model that is separately forwarded on computer disk. This is a description of the model at Critical Design Review (CDR), scheduled in April 1996. The report has been prepared in accordance with GSFC S-480-79, Performance Assurance Requirements (PAR) for the Earth Observing System (EOS) & Meteorological Satellites Project (METSAT) Advanced Microwave Sounding Units - A.

1.1 IDENTIFICATION

This is the Structural Math Model for the Meteorological Satellites Project (METSAT) Advanced Microwave Sounding Units - A (AMSU-A), Module A1. This report is submitted to fulfill the requirements of Contract NAS 5-32314 CDRL 102, Structural Math Model, for the METSAT AMSU-A1 Module. The Structural Math Model for the A2 module has been submitted under separate cover.

1.2 PURPOSE AND OBJECTIVES

The purpose of this report is to document the NASTRAN bulk data deck, transmitted under separate cover. The Structural Math Model is used to verify the structural adequacy of the AMSU-A1 instrument for loading environments specified in the GSFC S-480-79, Performance Assurance Requirements (PAR).

1.3 DOCUMENT STATUS AND SCHEDULE

This is the submittal of the Structural Math Model for the METSAT AMSU-A1 Module at CDR, April 1996.

SECTION 2

REFERENCE DOCUMENTS

The following documents were used in the preparation of this report:

SPECIFICATIONS

GSFC-S-480-79 October 10, 1994	Performance Assurance Requirements for the Earth Observing System (EOS) & Meteorological Satellites Project (METSAT) Advanced Microwave Sounding Units - A
GSFC 422-11-12-01	General Interface Requirements Document (GIRD) for EOS Common Spacecraft/Instruments EOS PM Project

Aerojet

Report 10737 November 1995	Advanced Microwave Sounding Unit-A (AMSU-A2), Structural Mathematical Model
Report 10805 March 1996	Integrated Advanced Microwave Sounding Unit-A (AMSU-A) METSAT Stress Analysis Report, A1 Module
Report 10372A February 1996	Earth Observing System (EOS)/Advanced Microwave Sounding Unit-A (AMSU-A) Structural Math Model - A1 Module
Report 10381 June 1995	Earth Observing System (EOS)/Advanced Microwave Sounding Unit-A (AMSU-A) Stress Analysis Report, A1 Module
Report 10381 Addendum 1 February 1996	Earth Observing System (EOS)/Advanced Microwave Sounding Unit-A (AMSU-A) Stress Analysis Report, A1 Module

SECTION 3

MODEL DESCRIPTION

3.1 FINITE ELEMENT MODEL

Figures 1a thru 1d display the NASTRAN finite element model of the METSAT AMSU-A1 structure. The basic coordinate system used in the METSAT analysis is identical to that used in the EOS analysis (Ref. Aerojet Report 10381). This orientation differs from the METSAT PAR document which utilizes the spacecraft coordinate system identified on GE ATN Spacecraft Assembly Drawing 3278200. A comparison of systems follows:

Aerojet METSAT Coordinate System	GSFC-S-79 PAR Coordinate System
+X-Axis	-Y-Axis
+Y-Axis	-Z-Axis
+Z-Axis	+X-Axis

The METSAT AMSU-A1 finite element model is a modification of the EOS AMSU-A1 finite element model. The METSAT AMSU-A1 Module is mounted to the spacecraft through a sidemount bracket. The EOS AMSU-A1 Module is mounted from the lower baseplate. The design of the primary structure is essentially the same for the two units except for the following:

1. Lower Baseplate - Different designs and drawings.
2. Sidemount - Only on METSAT.
3. Top Panel - Different designs and drawings.
4. Left Panel - Different designs and drawings.
5. Radiator Panel - Only on METSAT.
6. Signal Processor - METSAT has 2 Cards in Upper Card Cage.
EOS Upper Card Cage is empty. METSAT has 4 different Cards in Lower Card Cage.
7. Power Control/Monitor - Different designed enclosure and connectors.
8. Insulation and Mirror Tile representations - Modified.

The NASTRAN finite element model prepared for EOS AMSU-A1 and shown in Aerojet Report 10381 is modified for the METSAT AMSU-A1 design. In The current METSAT effort, a more refined NASTRAN model has been developed to more accurately represent the METSAT. The model statistics are:

9095	Grids (GRID)
1032	Bar/Beam Elements (CBAR AND CBEAM)
8089	Rectangular Plate Elements (CQUAD4)
664	Triangular Plate Elements (CTRIA3)
385	Point Mass Elements (CONM2)
23	Spring Elements (CELAS1)

The total mass of the model is 119.2 pounds (54.1 Kg). Mass properties, in the Aerojet METSAT Coordinate System Axes, at the center of gravity, are shown below. The cg is measured relative to the sidemount lower corner on the spacecraft side by the lower reflector (GRID 7508).

Mass	119.2 lb.	(54.1 kg)
Center of Gravity		
x	15.213 in	(0.386m)
y	8.839	(0.225)
z	9.918	(0.252)
Moment of Inertia (at cg)		
Ixx	7336 lb-in	(2.147 kg-m ²)
Ixy	36	(0.011)
Ixz	1799	(0.526)
Iyx	36	(0.011)
Iyy	12574	(3.679)
Iyz	151	(0.044)
Izx	1799	(0.526)
Izy	151	(0.044)
Izz	9100	(2.663)

Concentrated mass elements (CONM2's) used in the model are listed in Table I. Material properties used in the model are shown in Table II. Parasitic mass, representing non-structural and miscellaneous items such as insulation, mirror tiles, wiring, mounting hardware, etc., are distributed throughout the model components by non-structural mass additions to the element properties or by increasing the mass density of the material.

Appendix A presents a detailed description of the METSAT NASTRAN finite element model.

3.2 BOUNDARY CONDITIONS

The model is constrained for static design load cases along the three orthogonal axes on the sidemount at each of the 16 spacecraft mounting bolt locations and along the two transverse axes (X and Z in Figure 1) at the 2 dowel pin locations. The constraints are imposed using NASTRAN single point constrain cards.

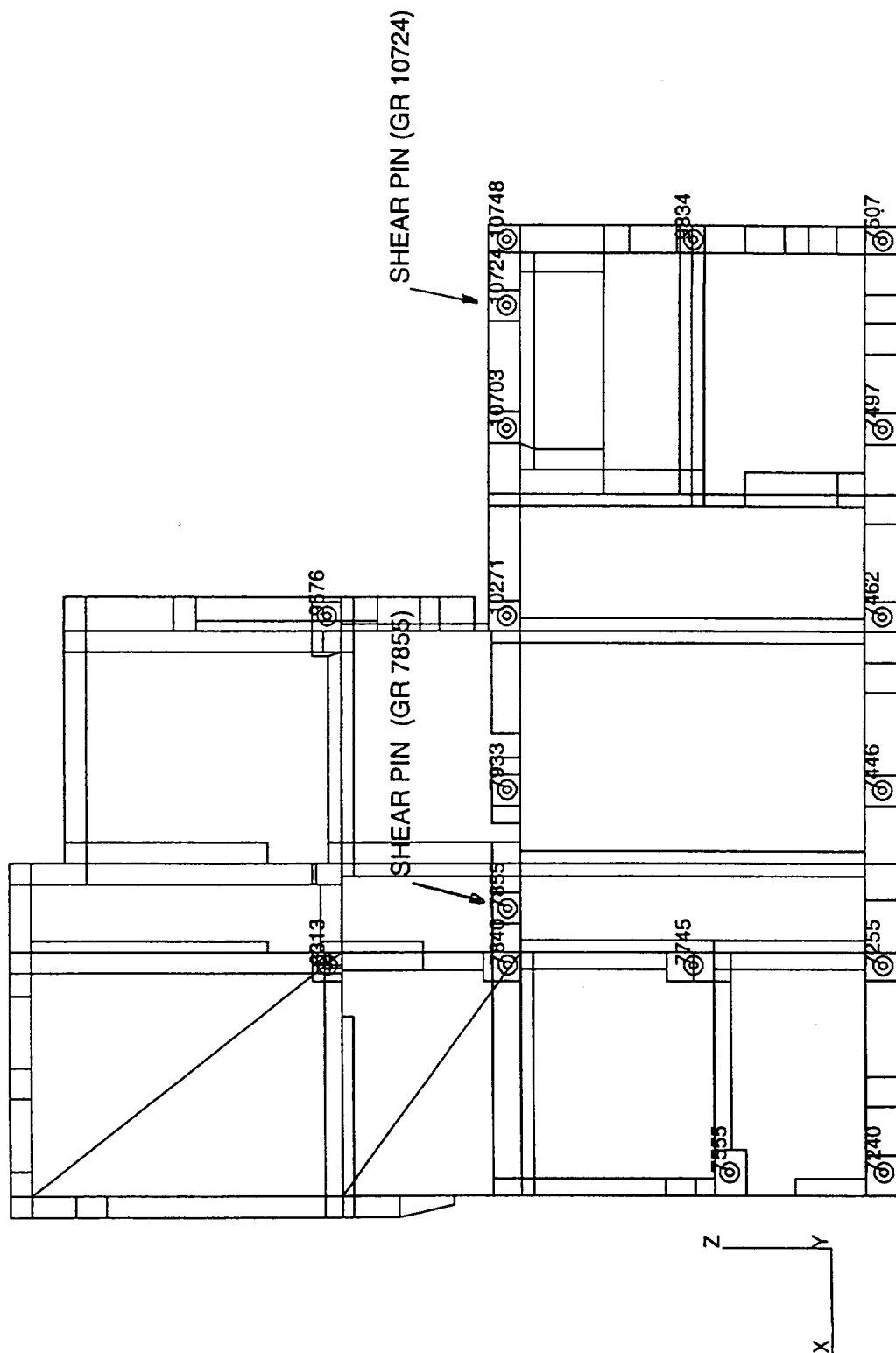


FIGURE 1 METSAT AMSU-A1 1331552-1 SIDEMOUNT MOUNTING BOLT GRIDS

TABLE I CONCENTRATED MASS ELEMENTS (CONM2)

CONM2 ELEMENT	GRID POINT	ITEM	NO. CONM2 (LB)	INCR WEIGHT (LB)	TOTAL WEIGHT (LB)
4957-4976	3001-3010, 3031-3039	LOWER WARMLOAD	20	0.1469	2.938
4977-4996	2941-2950, 2971-2980	UPPER WARMLOAD	20	0.1469	2.938
10341-10344	1345, 2154, 2130, 1365	UPPER CAGE CARD RETAINER	4	0.034	0.136
5747-5748	3735, 3711	LOWER CARD CAGE CARDS	2	0.601	1.202
5749-5758	3706-3708, 3730-3732	LOWER CARD CAGE CARDS	10	0.475	4.75
	3749-3750, 3760-3761				
5743-5744	3676-3677	LOWER CARD CAGE CARDS	2	0.057	0.114
5759-5760	3764, 3753	LOWER CARD CAGE CARDS	2	0.64	1.28
5761-5762	3663, 3665	LOWER CARD CAGE CARDS	2	0.251	0.502
5745-5746	3699-3700	LOWER CARD CAGE CARDS	2	0.294	0.588
1748-1750	2547, 2549, 2551	UPPER SHELF COMPONENTS	3	0.40333	1.20999
1742-1745	2419, 2421, 2353, 2355	UPPER SHELF COMPONENTS	4	0.03543	0.14172
1746-1747	2405, 2366	UPPER SHELF COMPONENTS	2	0.07085	0.1417
1706-1717	2460, 2502, 2473, 2487	UPPER SHELF COMPONENTS	12	0.13445	1.6134
	2475, 2489, 2314, 2300				
	2302, 2287, 2289, 2275				
1738-1741	2422, 2426, 2356, 2360	UPPER SHELF COMPONENTS	4	0.23668	0.9467
1722-1725	2420, 2424, 2354, 2358	UPPER SHELF COMPONENTS	4	0.22168	0.8867
1718-1721	2465, 2470, 2521, 2526	UPPER SHELF COMPONENTS	4	0.39656	1.58625
1726-1737	2572, 2577, 2534, 2539	UPPER SHELF COMPONENTS	12	0.39656	4.75874
	2520, 2525, 2464, 2469				
	2318, 2323, 2241, 2242				
859-862	1777, 1779, 1826, 1828	LOWER SHELF COMPONENTS	4	0.0001	0.0004
847-850	1774, 1776, 1842, 1844	LOWER SHELF COMPONENTS	4	0.53194	2.12775
855-858	1727-1728, 1743-1744	LOWER SHELF COMPONENTS	4	0.1025	0.41
835-838	1778, 1800, 1827, 1850	LOWER SHELF COMPONENTS	4	0.39281	1.57125
866-869	1629, 1631, 1647, 1649	LOWER SHELF COMPONENTS	4	0.1725	0.69
870-877	1634, 1637, 1641, 1652,	LOWER SHELF COMPONENTS	8	0.24838	1.987
	1659, 1671, 1677, 1678				
878-881	1669-1670, 1699-1700	LOWER SHELF COMPONENTS	4	0.0635	0.254
882-885	1674, 1676, 1703, 1705	LOWER SHELF COMPONENTS	4	0.292	1.168
886-889	1781, 1783, 1811, 1814	LOWER SHELF COMPONENTS	4	0.12	0.48
890-893	1716, 1718, 1764, 1766	LOWER SHELF COMPONENTS	4	0.15925	0.637
894-897	1731-1732, 1762-1763	LOWER SHELF COMPONENTS	4	0.19375	0.775
898-903	1719, 1720, 1735, 1751	LOWER SHELF COMPONENTS	6	0.10333	0.62
	1767-1768				
843-846	1805, 1808, 1855, 1858	LOWER SHELF COMPONENTS	4	0.39031	1.56125
851-854	1625, 1628, 1691, 1694	LOWER SHELF COMPONENTS	4	0.52856	2.11425
863-865	1852-1854	LOWER SHELF COMPONENTS	3	0.22933	0.688
839-842	1664, 1667, 1712, 1715	LOWER SHELF COMPONENTS	4	0.34	1.36

TABLE I CONCENTRATED MASS ELEMENTS (CONM2)

CONM2 ELEMENT	GRID POINT	ITEM	NO. CONM2 (LB)	INCR WEIGHT (LB)	TOTAL WEIGHT (LB)
10677-10684	9561, 8876, 8315, 7842 7747, 7556, 9425, 9251	SIDEMOUNT T-BLANKET	8	0.04	0.32
10035-10037	2768, 2764, 2760	ALIGNMENT CUBE	3	0.116	0.348
4997-5000	2224, 2223, 2218, 2219	DC/DC CONVERTER	4	0.91	3.64
4945-4956	1970-1981	LOWER FEEDHORN & SHROUD	12	0.04167	0.5
4933-4944	2036-2038, 2047-2050 2058-2062	UPPER FEEDHORN & SHROUD	12	0.04167	0.5
4630	4077	LOWER REFL MOTOR ROTOR	1	1.25	1.25
4629	4078	LOWER REFL RESVLR ROTOR	1	0.31	0.31
4755-4770	4630-4645	LOWER REFL MOTOR STATOR	16	0.1	1.6
4771-4786	4646-4661	LOWER REFL RESOLVER	16	0.047	0.752
4215	4391	UPPER REFL MOTOR ROTOR	1	1.25	1.25
4214	4392	UPPER REFL RESVLR ROTOR	1	0.31	0.31
4707-4722	4597-4612	UPPER REFL MOTOR STATOR	16	0.1	1.6
4723-4738	4613-4628	UPPER REFL RESOLVER	16	0.047	0.752
5001-5004	1961, 1963, 1885, 1883	DETECTOR PREAMP	4	0.7225	2.89
5037-5054	1435, 1445, 1580-1586 1588, 1590-1596, 1598	UPPER B-PLATE T-BLANKET	18	0.00257	0.04633
5055-5706	2884-2899	LOWER REFL T-BLANKET	16	0.00182	0.02904
5071-5086	4597-4612	UPPER REFL T-BLANKET	16	0.00182	0.02904
10665-10676	5706, 5674, 5663, 5630	PWR CNTRL/MON CONNECTOR	4	0.017	0.068
10669-10672	5621, 5620, 5714, 5682	PWR CNTRL/MON CONNECTOR	4	0.017	0.068
10673-10676	11752, 11754, 11730, 11736	PWR CNTRL/MON CONNECTOR	4	0.017	0.068
6833	6669	PWR CNTRL/MON CONNECTOR	1	0.044	0.044
6834	6670	PWR CNTRL/MON CONNECTOR	1	0.022	0.022
6835	6671	PWR CNTRL/MON CONNECTOR	1	0.022	0.022
6836-6838	5966, 5911, 5999	PWR CNTRL/MON RELAY	3	0.06	0.18
6839-6841	6044, 5994, 6015	PWR CNTRL/MON RELAY	3	0.06	0.18

TABLE I CONCENTRATED MASS ELEMENTS (CONM2)

CONM2	GRID	ITEM	NO.	INCR	TOTAL
ELEMENT	POINT		CONM2	WEIGHT	WEIGHT
			(LB)	(LB)	(LB)
5824-5832	2065-2067, 2077-2079	TRANSISTOR ASSEMBLY	9	0.055	0.495
	2089-2091				
10122-10127	10963-10968	RADIATOR PANEL BRACKET	6	0.0053	0.0318
10742-10751	11275, 11323, 11315, 11307	UP CARD CAGE CONNECTOR	5	0.01	0.05
	11307, 11299				
	11187, 11890, 11882,	UP CARD CAGE CONNECTOR	5	0.01	0.05
	11874, 11211				
		TOTAL			59.5823

TABLE II MATERIAL PROPERTIES

MAT'RL	MAT'RL	COMPONENT	E	μ	ρ
ID	TYPE		(PSI)		(LB/IN ³)
1	7075 ALUM	UPPER FRONT PANEL, MOTOR MT PANLES	1.03E+07	0.33	0.11
2, 6, 7, 9	6061 ALUM	LOWER BASEPLATE, LOWER FRONT PANEL	9.90E+06	0.33	0.107
		LOWER AFT PANEL, UPPER BASEPLATE			
		UPPER AFT PANEL, LOWER RIGHT PANEL			
		UPPER & LOWER RIGHT FRONT SUPPORTS			
		UPPER RIGHT PANEL, TOP PANEL, LEFT PANEL			
		UPPER & LOWER WARMLOAD SHIELDS			
		UPPER & LOWER CARD CAGES			
		UPPER & LOWER WARMLOAD STRUCTURES			
3	FIBERGLAS	PWR CTRL/MONITOR PWB, UPPER SHELF BKTS	2.00E+06	0.12	0.07
4	6061 ALUM	LOWER BASEPLATE	9.90E+06	0.33	0.183
5	6061 ALUM	SIDEMOUNT	9.90E+06	0.33	0.12138
8	BERYLLIUM	RF SHELVES	4.25E+07	0.1	0.067
10	FIBERGLAS	LOWER CARD CAGE CIRCUIT CARDS	2.00E+06	0.12	0.16673
11	CRES	POWER CTRL/MONITOR STANDOFFS	2.60E+07	0.27	0.286
12	6061 ALUM	POWER CTRL/MONITOR BKT, RADIATOR PANEL	9.90E+06	0.33	0.098
13	*****	FICTITIOUS MASSLESS MATERIAL	1.00E+02	0.3	1E-06
14	FIBERGLAS	UPPER CARD CAGE CIRCUIT CARDS	2.00E+06	0.12	0.10876
15	6061 ALUM	TOP PANEL W/MIRROR	9.90E+06	0.33	0.10366
30	6061 ALUM	REFLECTOR ASSEMBLIES	9.90E+06	0.33	0.107
106	STEEL	MOTOR SHAFT	2.90E+07	0.3	0.283
*LOWER AFT AND UPPER AFT PANELS, MODELED AS 6061 ALUM, ANALYZED AS 2024 ALUM					

APPENDIX A

NASTRAN FINITE ELEMENT MODEL

The NASTRAN finite element model of the METSAT AMSU-A1 Module is shown in its entirety in Figures A1a thru A1d in this appendix. Figure A1d is a section view of the model, showing the components modeled in the interior (i.e. shelves, card cages, warmload structures). Elements and grids are highlighted in the piece part models that are combined to form the METSAT AMSU-A1 Module model.

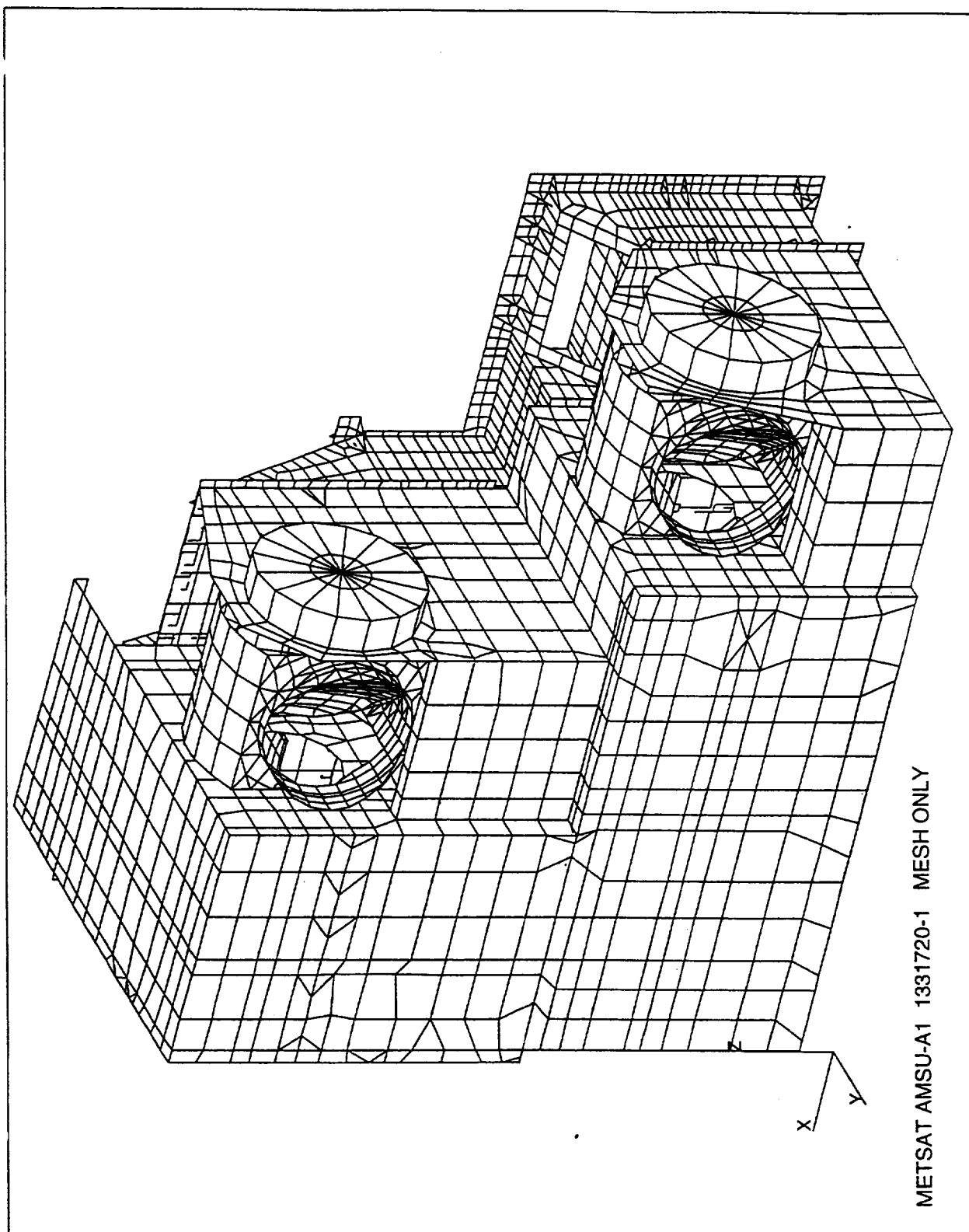


Figure A-1a METSAT AMSU-A1 1331720-1 Mesh Only

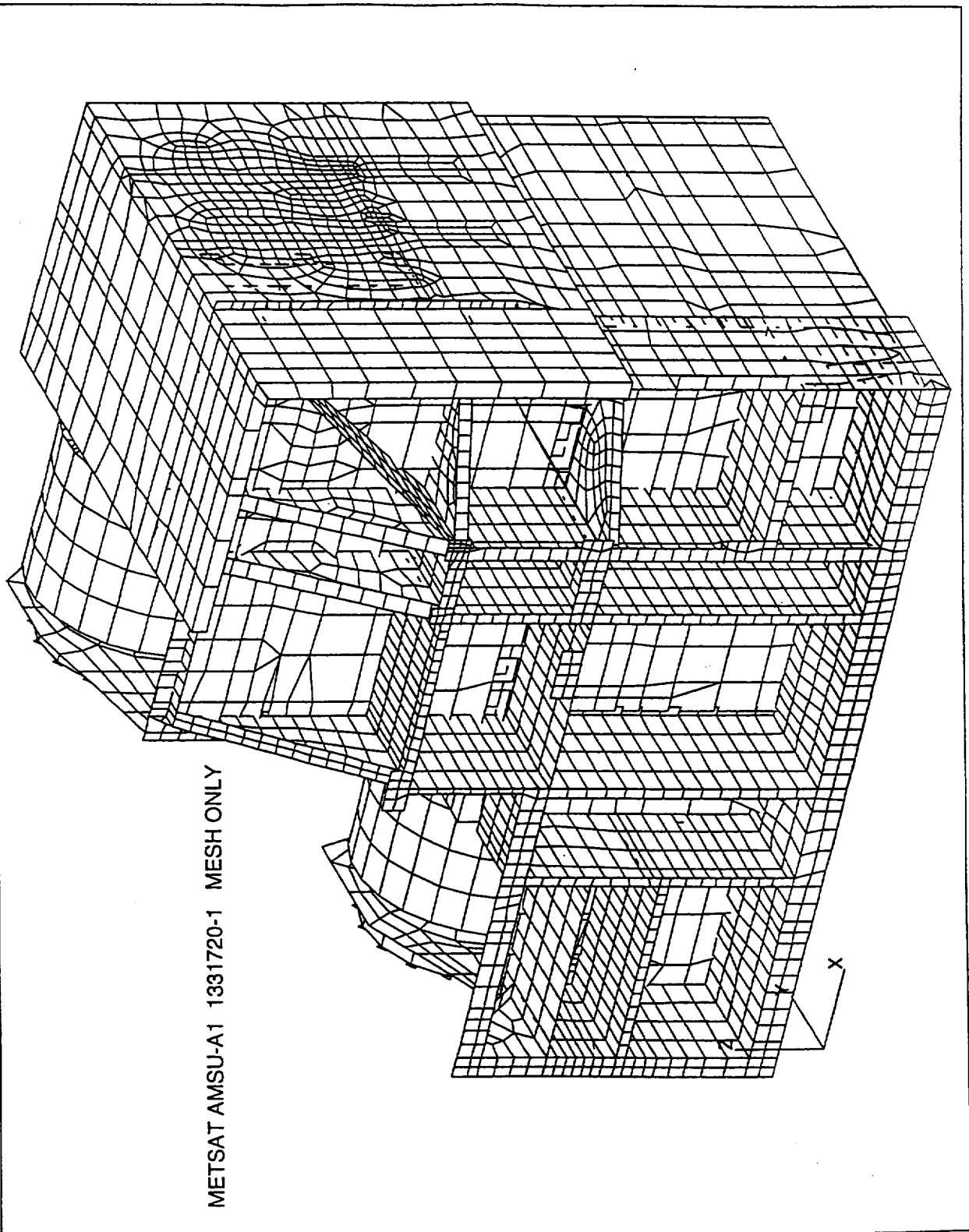


Figure A-1b METSAT AMSU-A1 1331720-1 Mesh Only

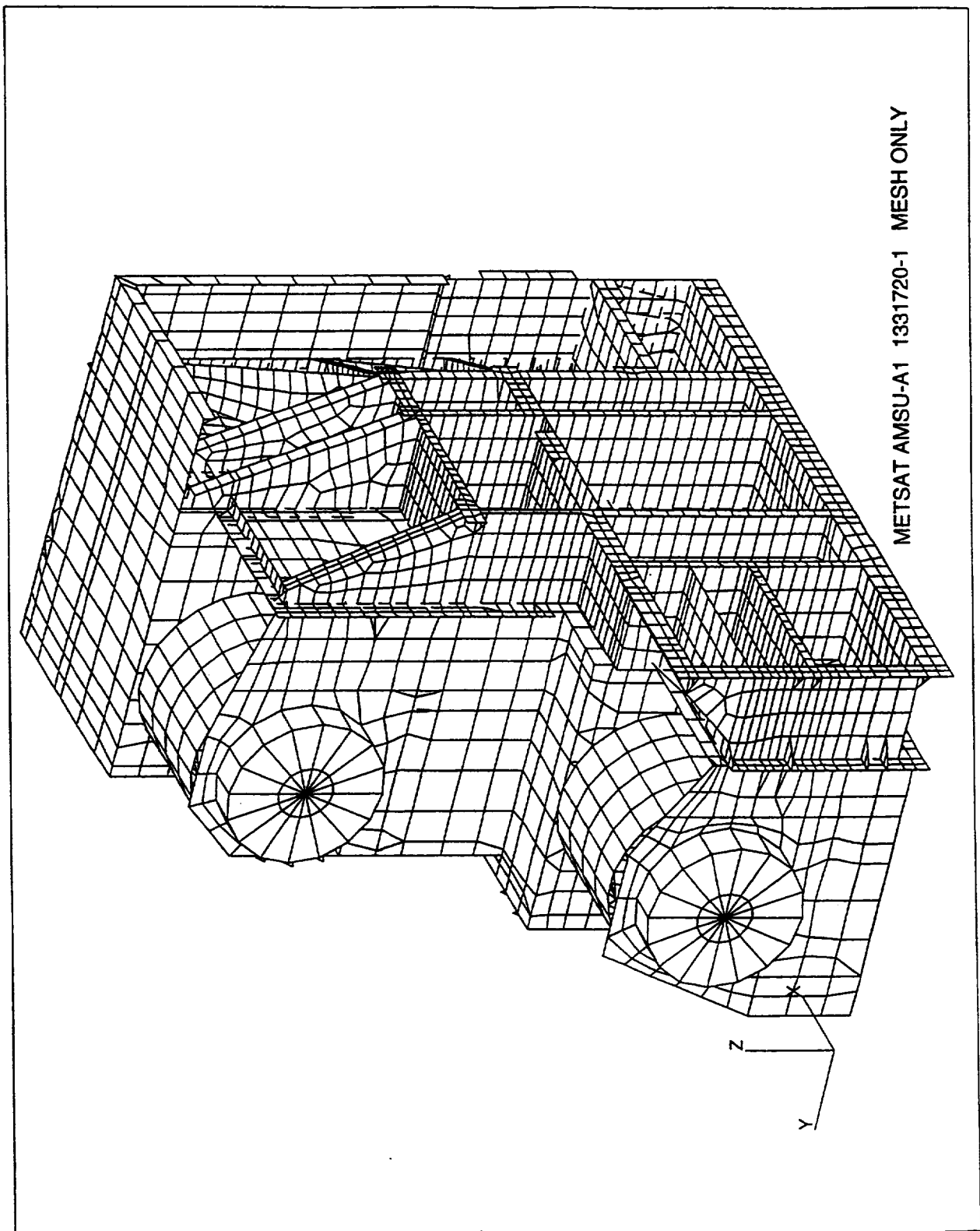


Figure A-1c METSAT AMSU-A1 1331720-1 Mesh Only

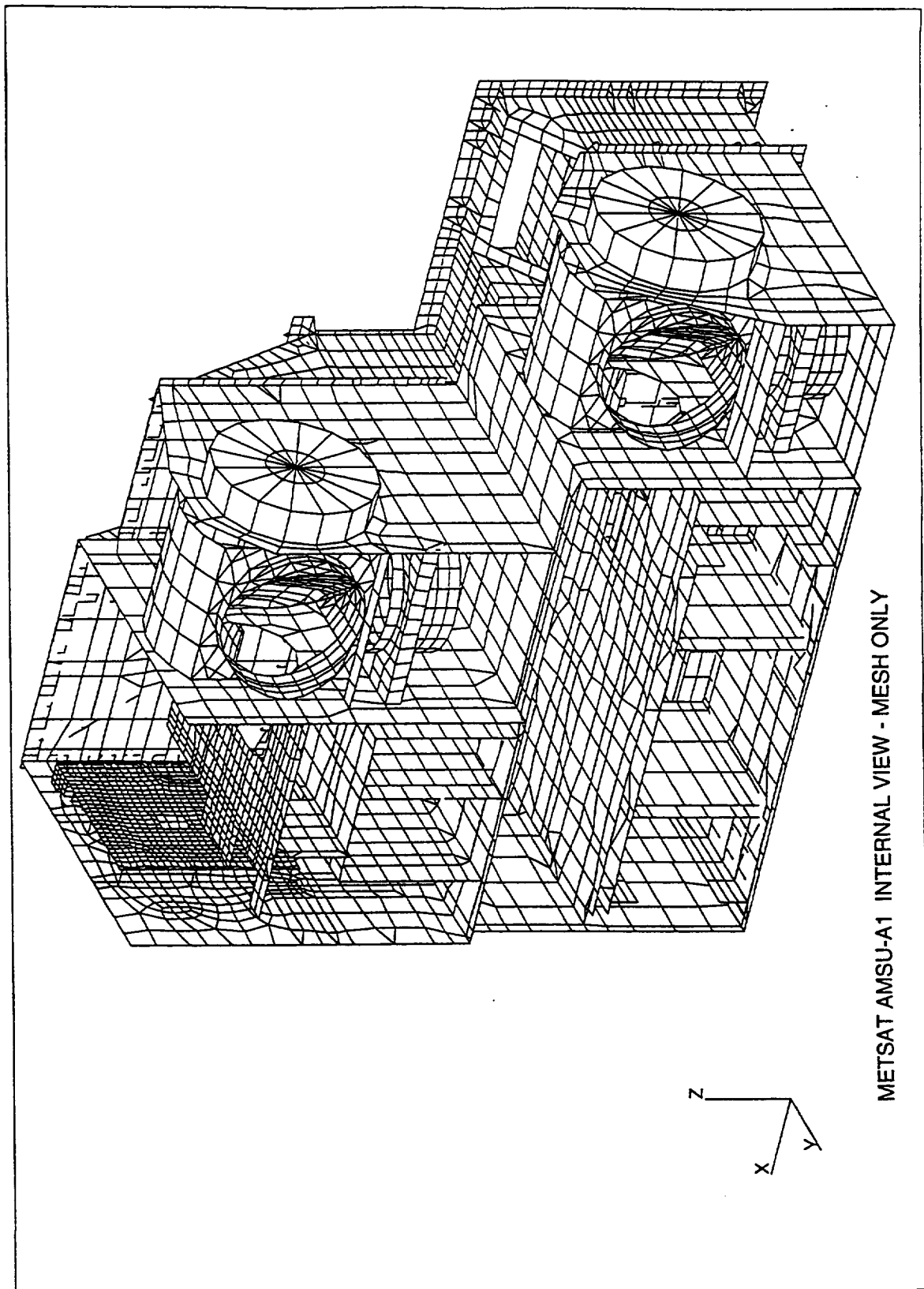


Figure A-1d METSAT AMSU-A1 1331720-1 Mesh Only

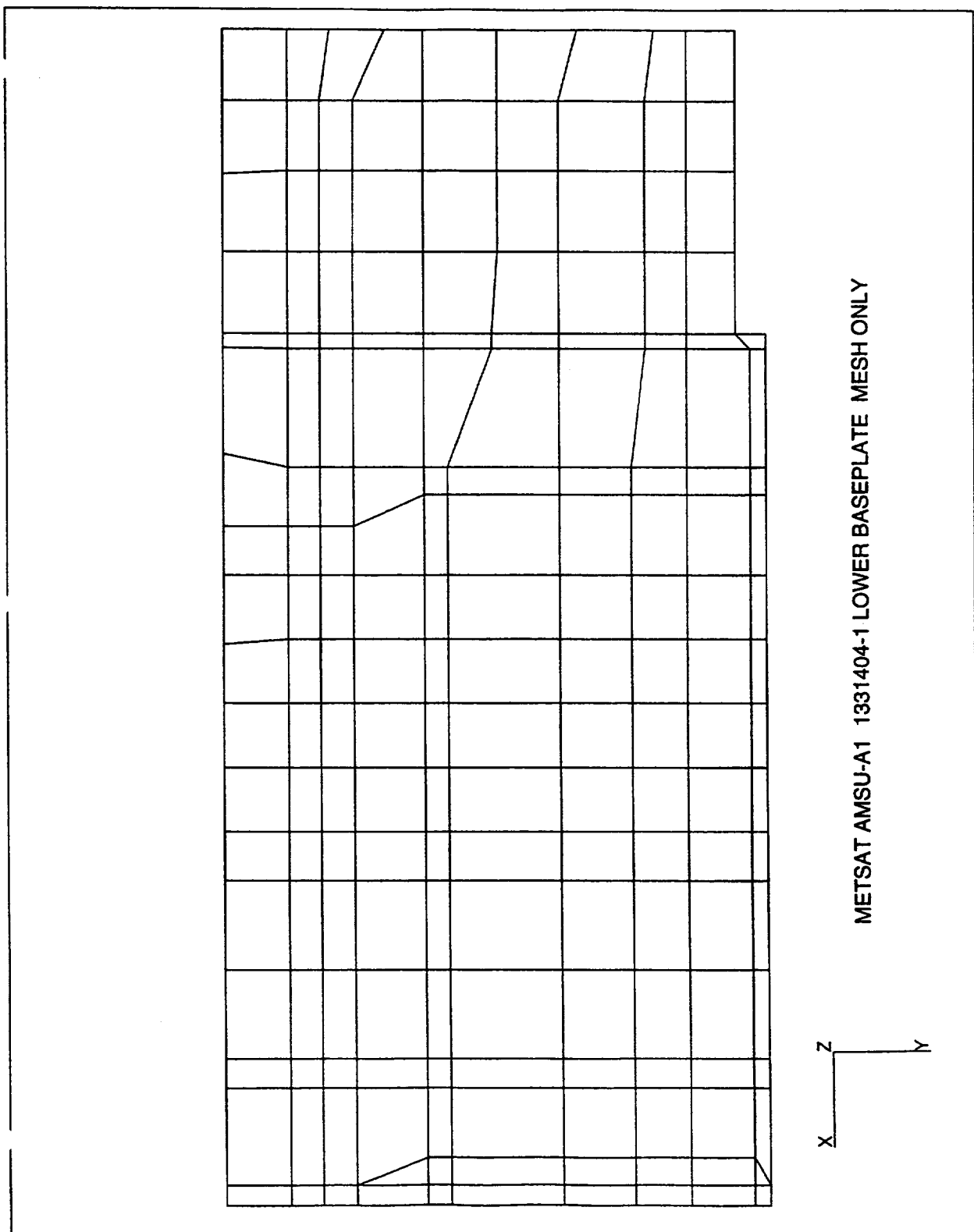


Figure A-2 METSAT AMSU-A1 1331404-1-1 Lower Baseplate Mesh Only

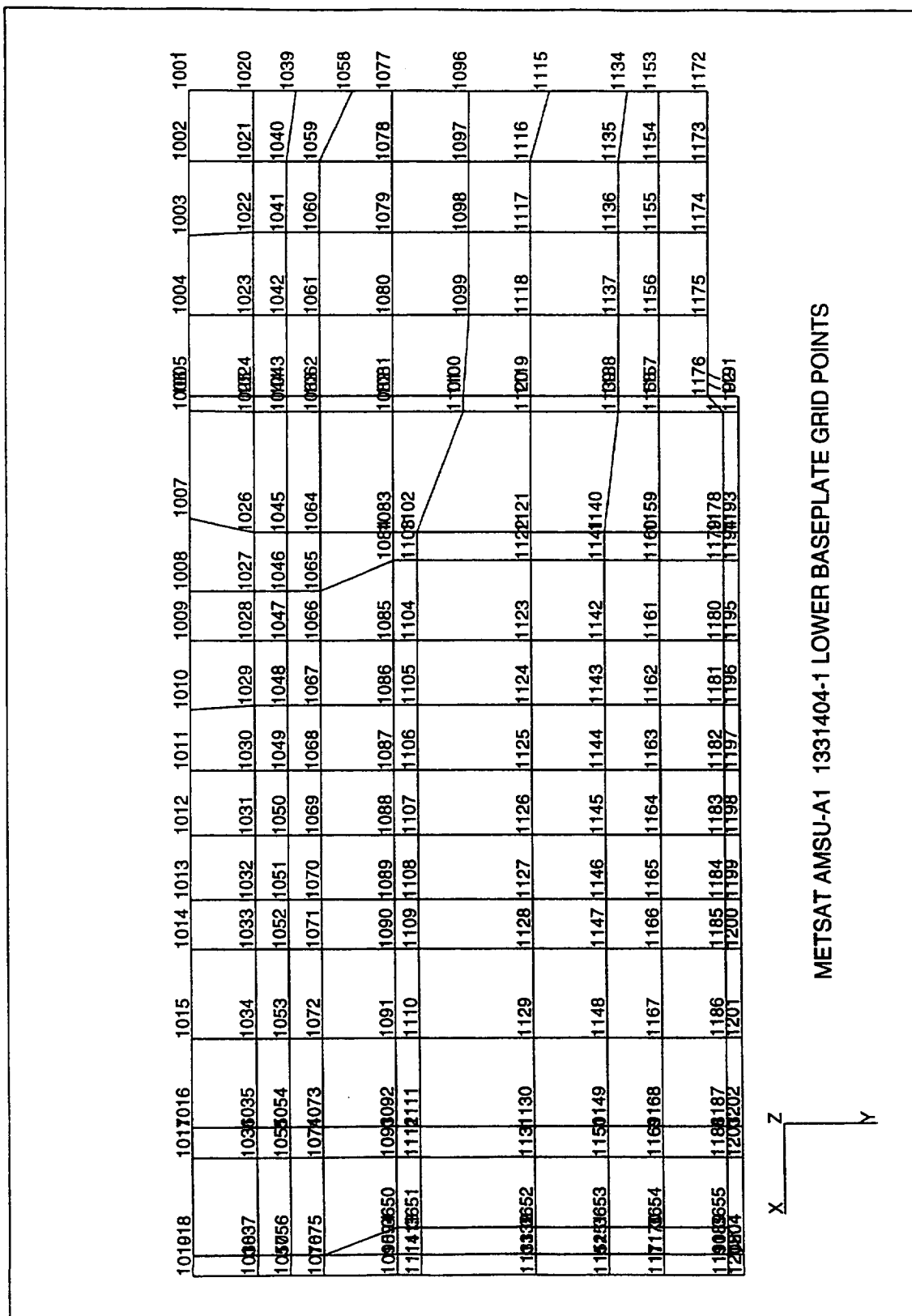


Figure A-3 METSAT AMSU-A1 1331404-1 Lower Baseplate Grid Points

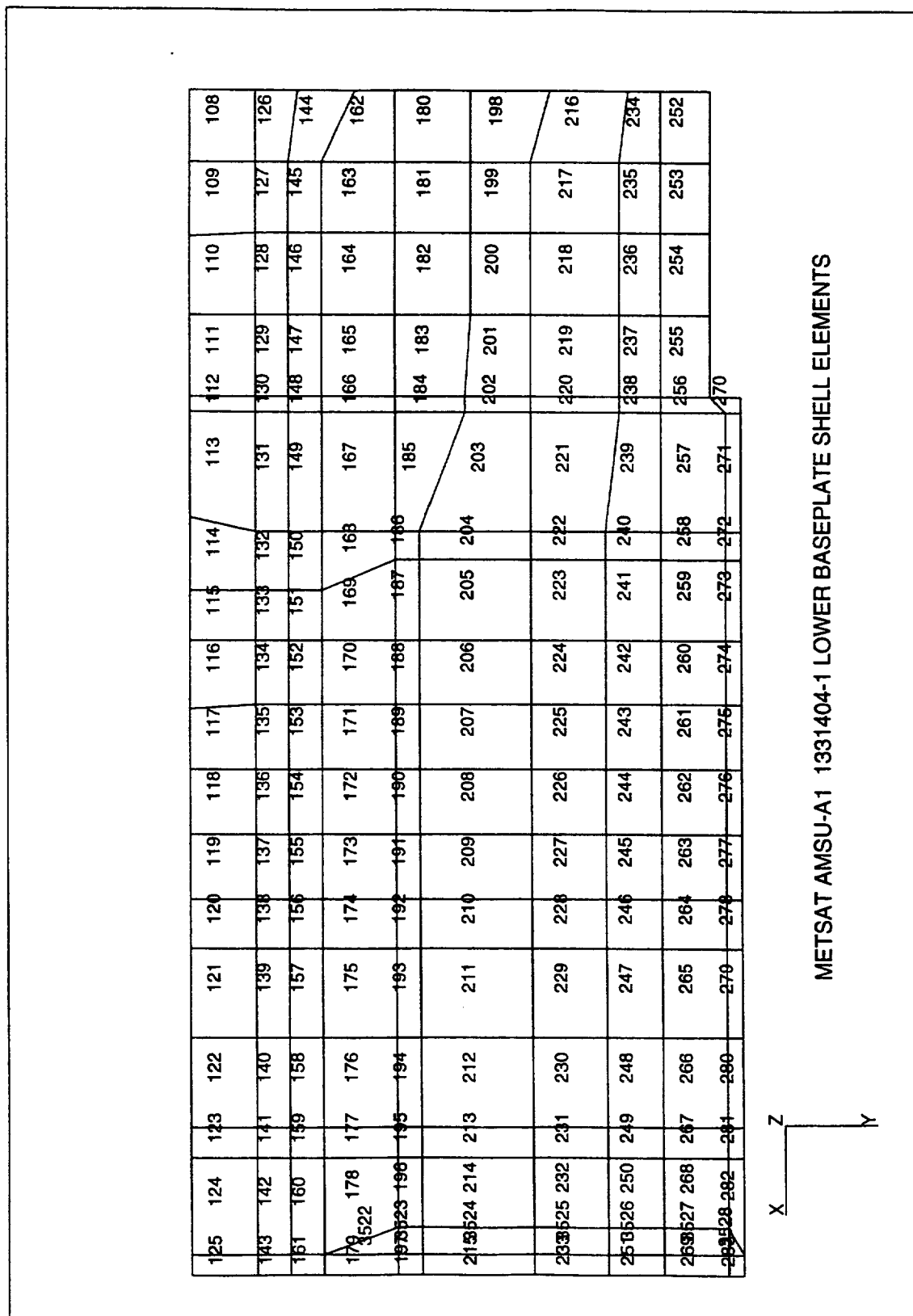


Figure A-4 METSAT AMSU-A1 1331404-1 Lower Baseplate Shell Elements

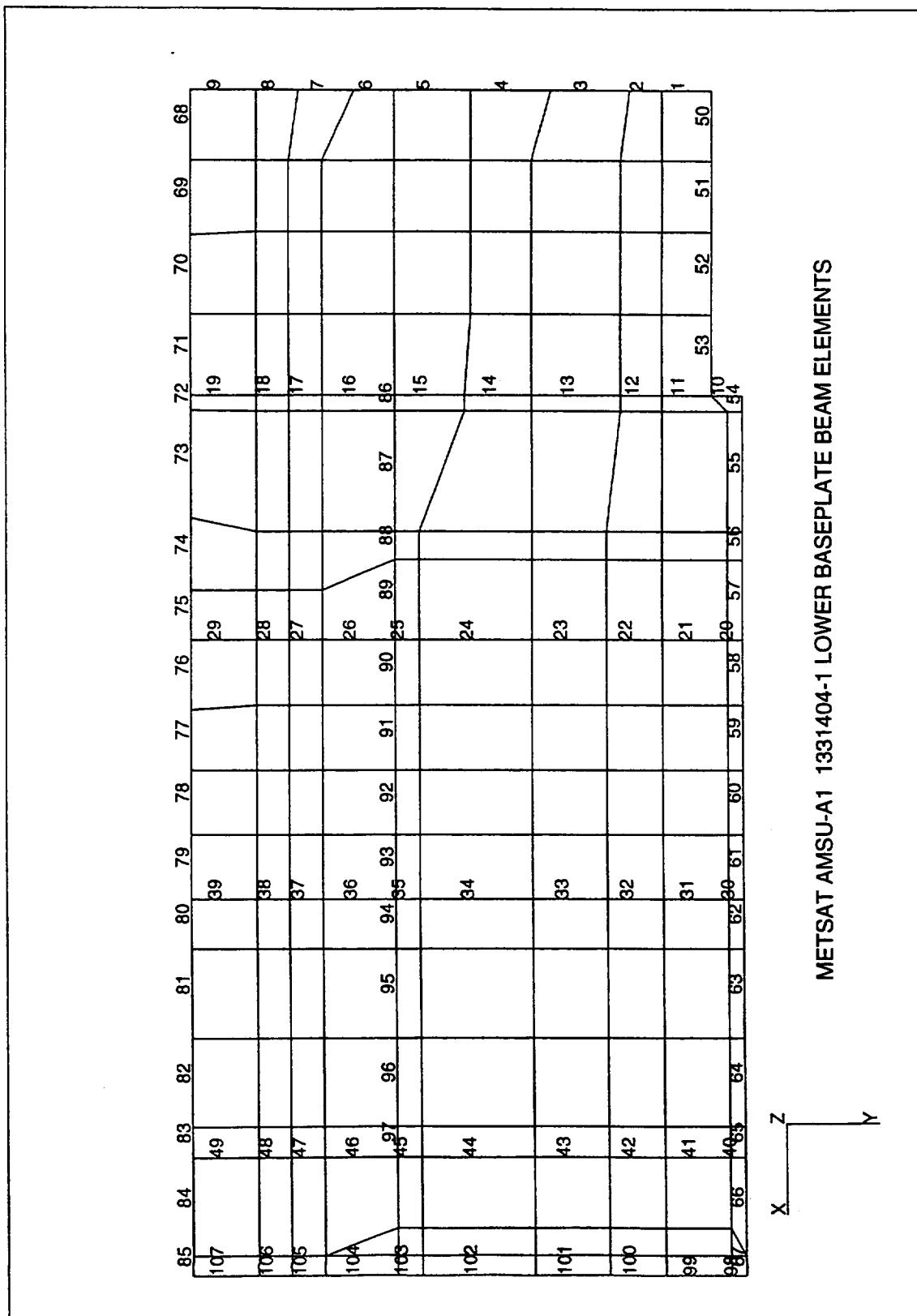


Figure A-5 METSAT AMSU-A1 1331404-1 Lower Baseplate Beam Elements

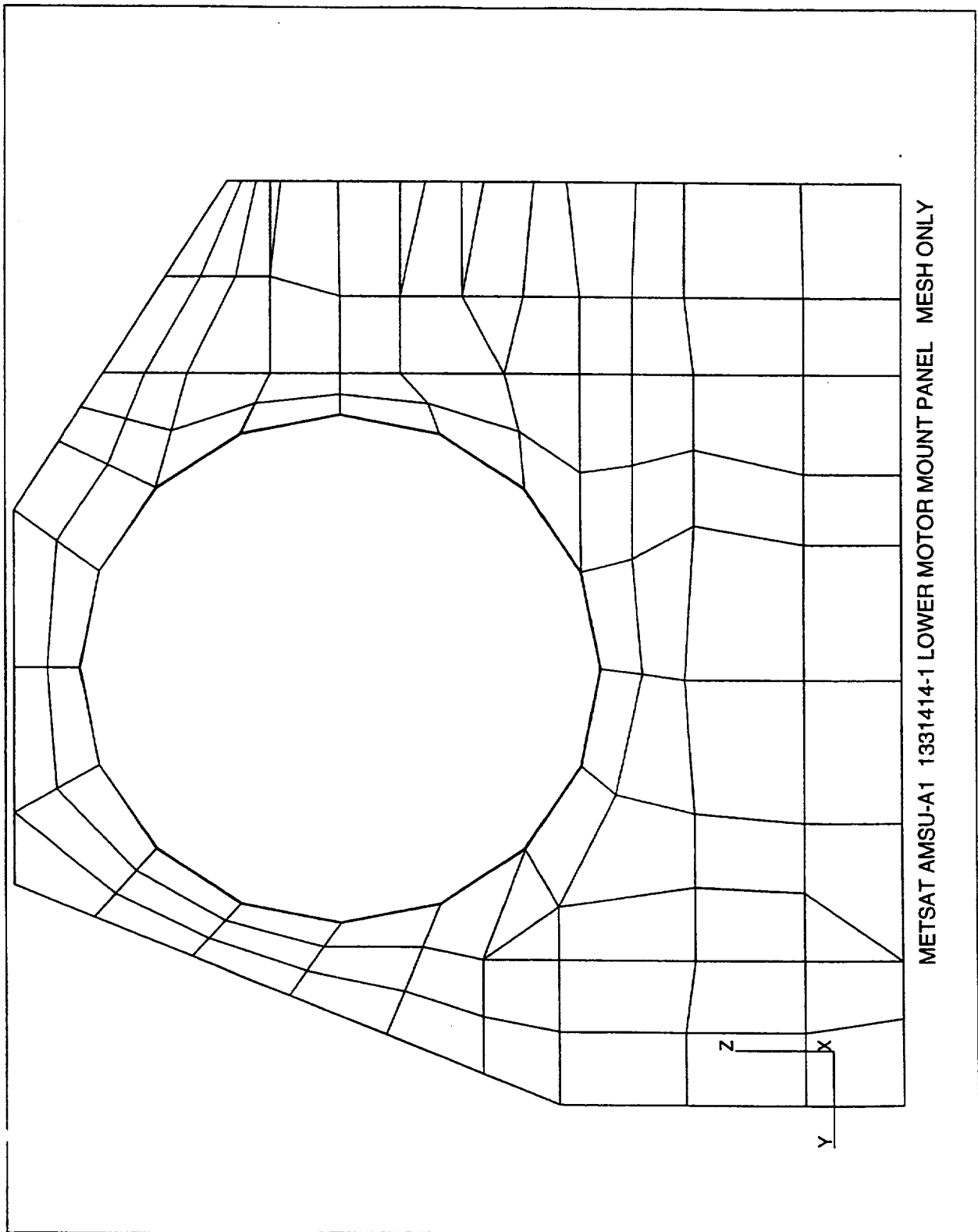


Figure A-6 METSAT AMSU-A1 1331414-1 Lower Motor Mount Panel Mesh Only

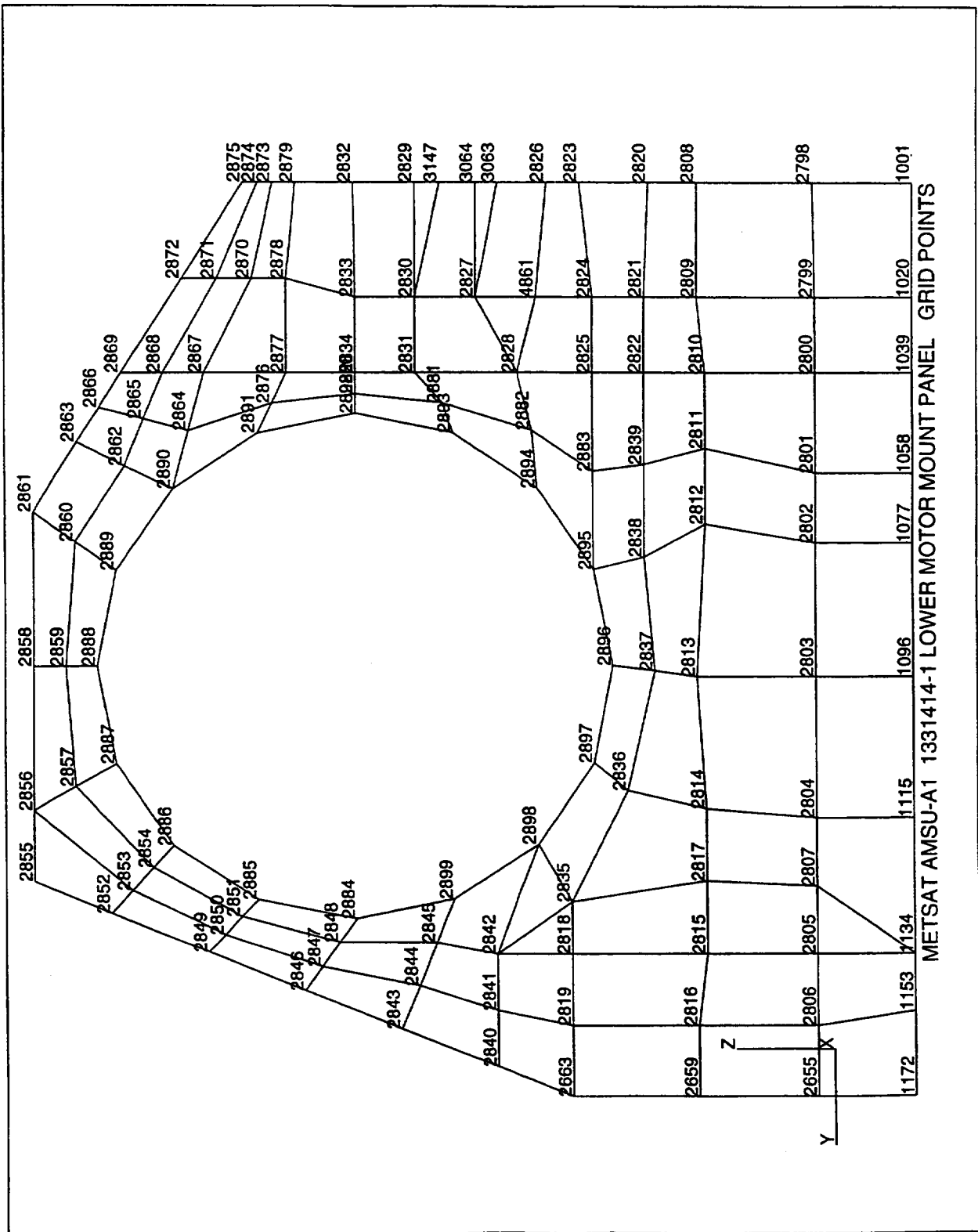


Figure A-7 METSAT AMSU-A1 1331414-1 Lower Motor Mount Panel Grid Points

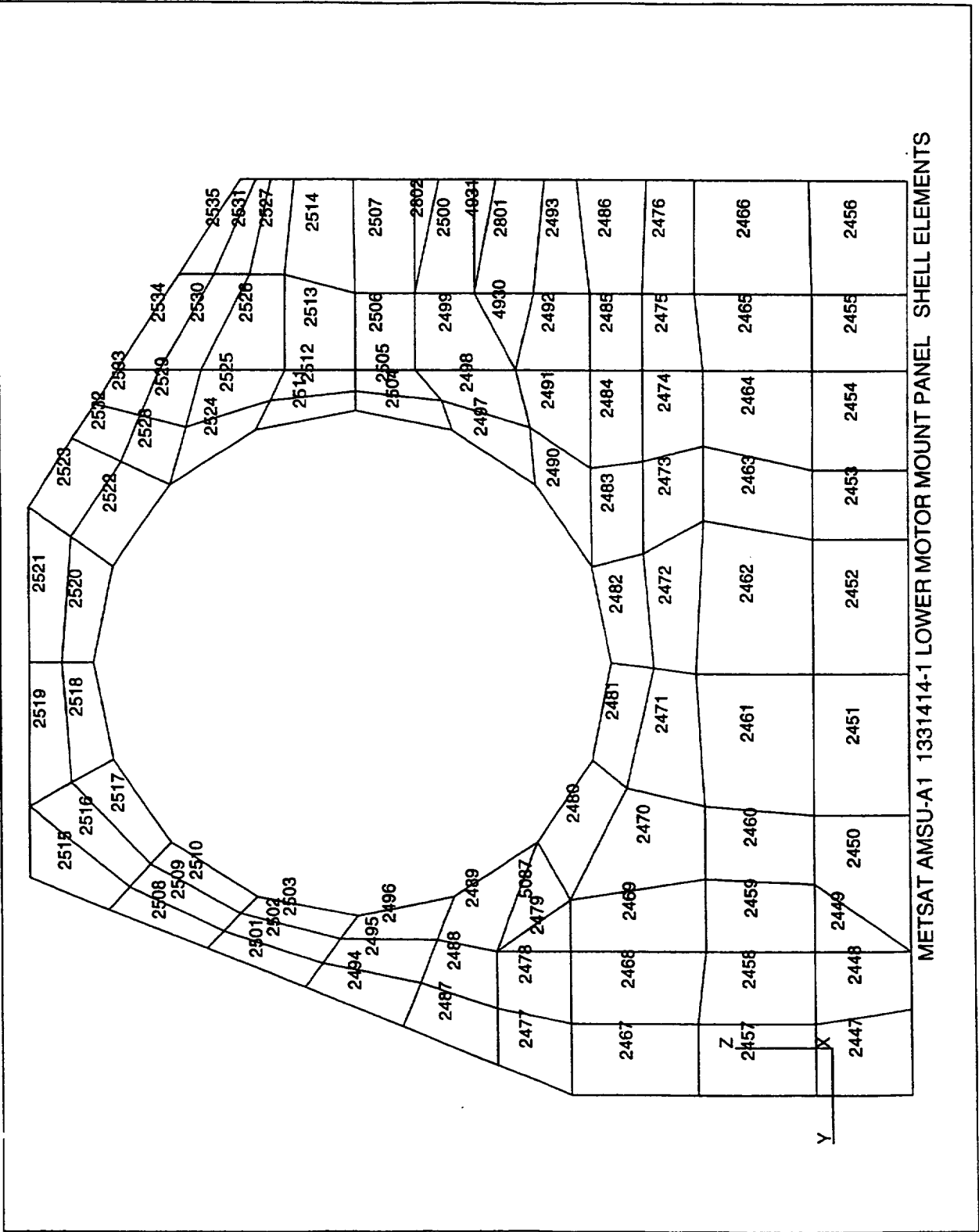


Figure A-8 METSAT AMSU-A1 13314141-1 Lower Motor Mount Panel Shell Elements

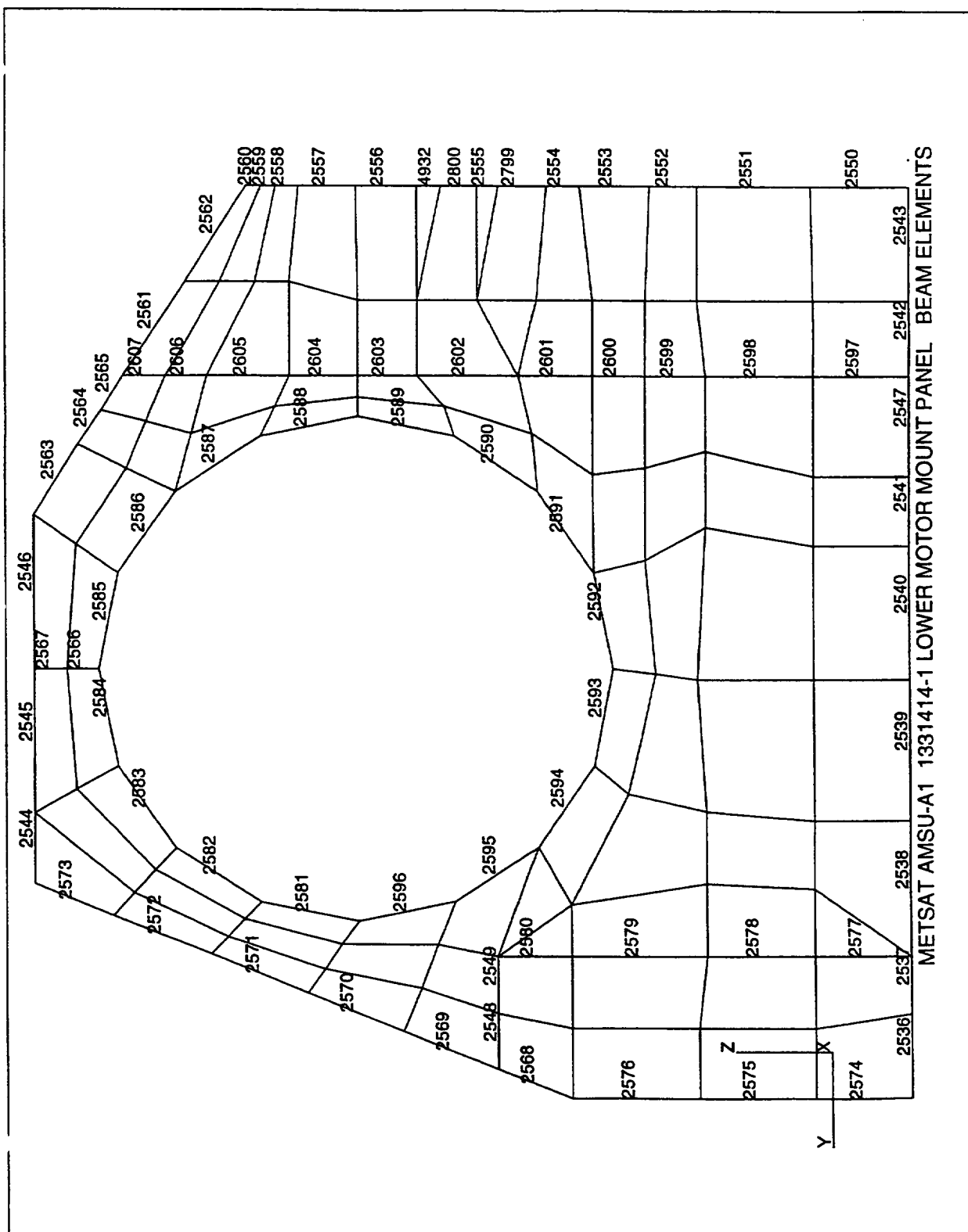


Figure A-9 METSAT AMSU-A1 13314141-1 Lower Motor Mount Panel Beam Elements

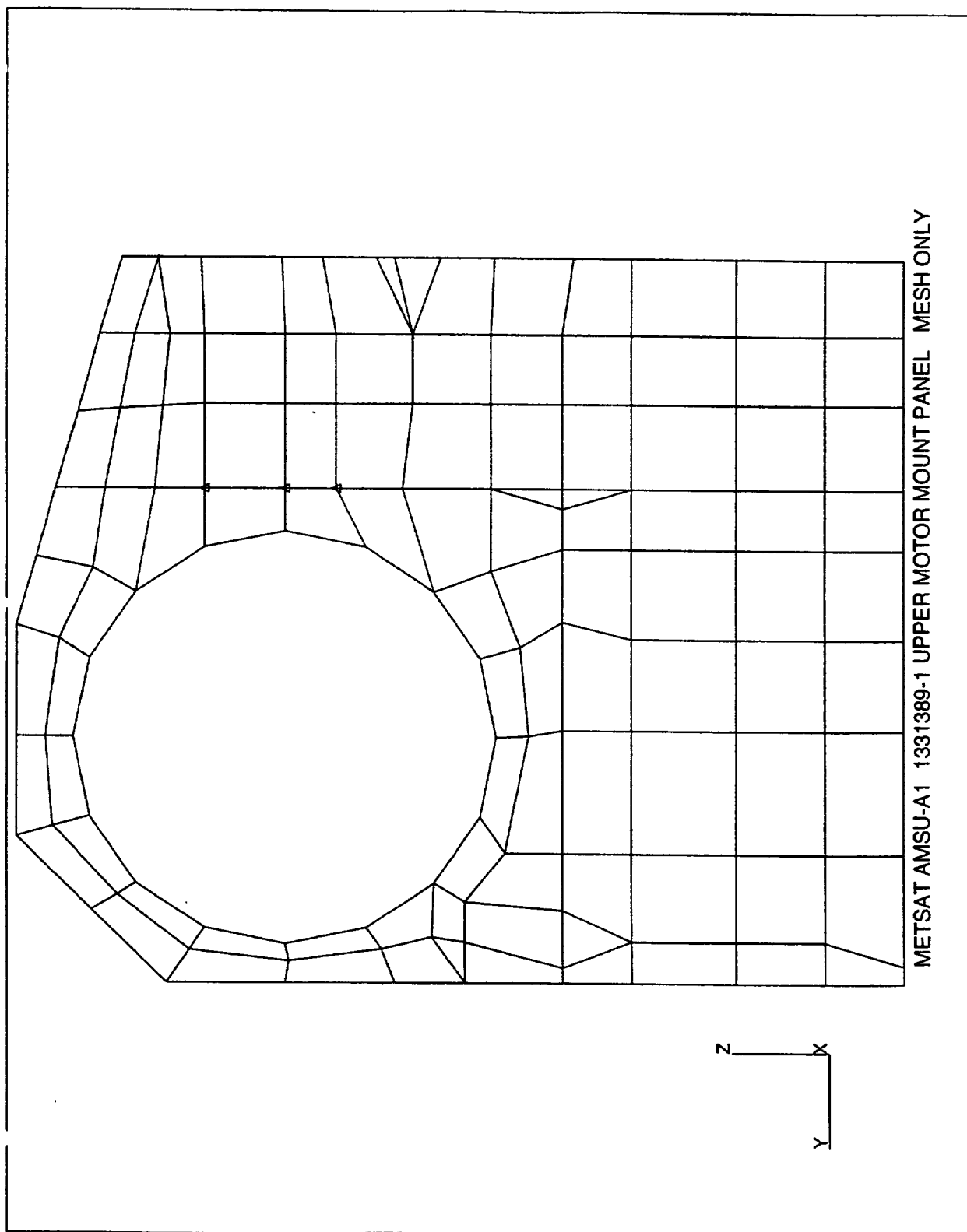


Figure A-10 METSAT AMSU-A1 1331389-1 Upper Motor Mount Panel Mesh Only

A-15

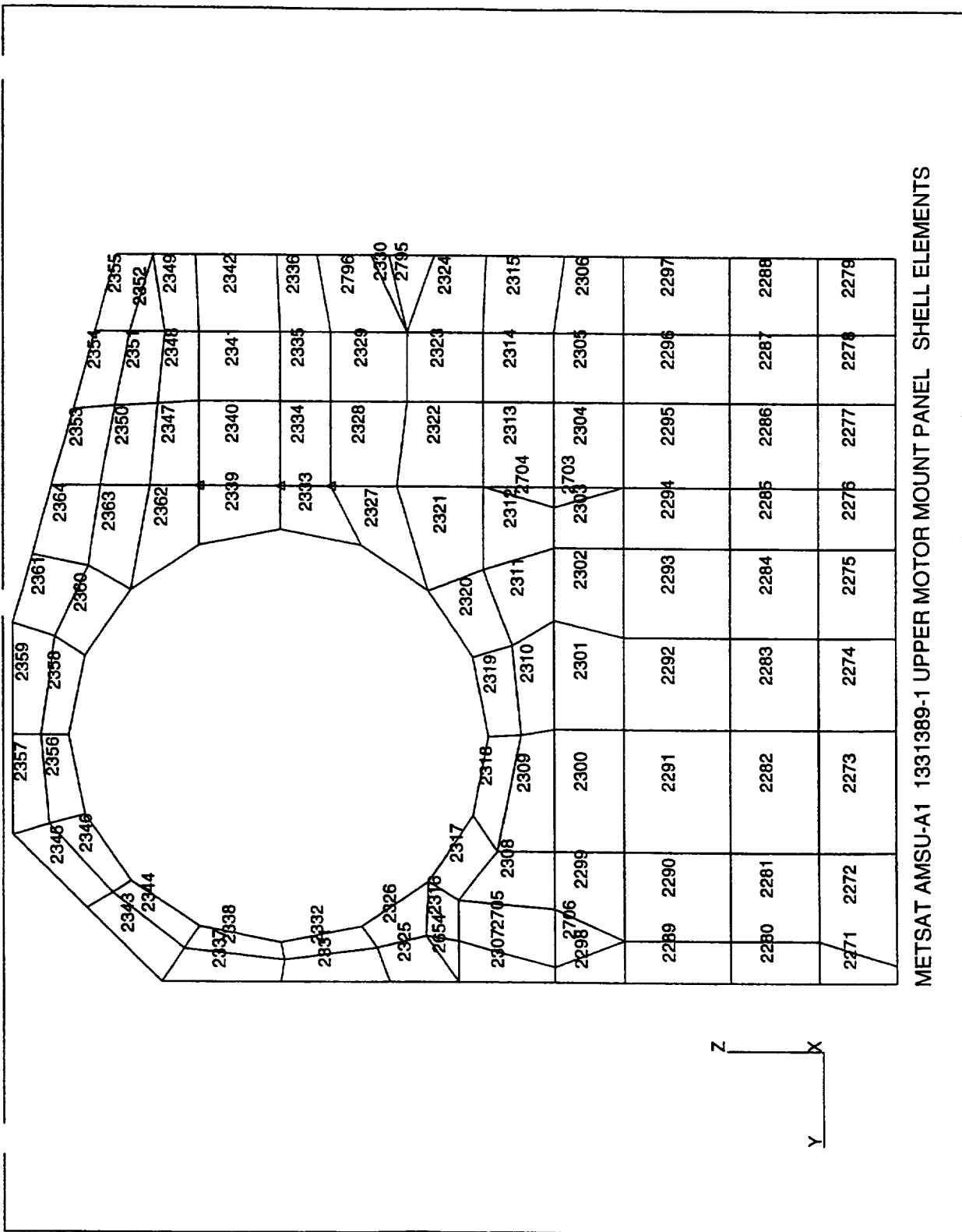


Figure A-12 METSAT AMSU-A1 1331389-1 Upper Motor Mount Panel Shell Elements

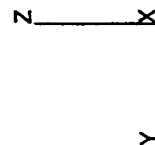


Figure A-13 METSAT AMSU-A1 1331389-1 Upper Motor Mount Panel Beam Elements

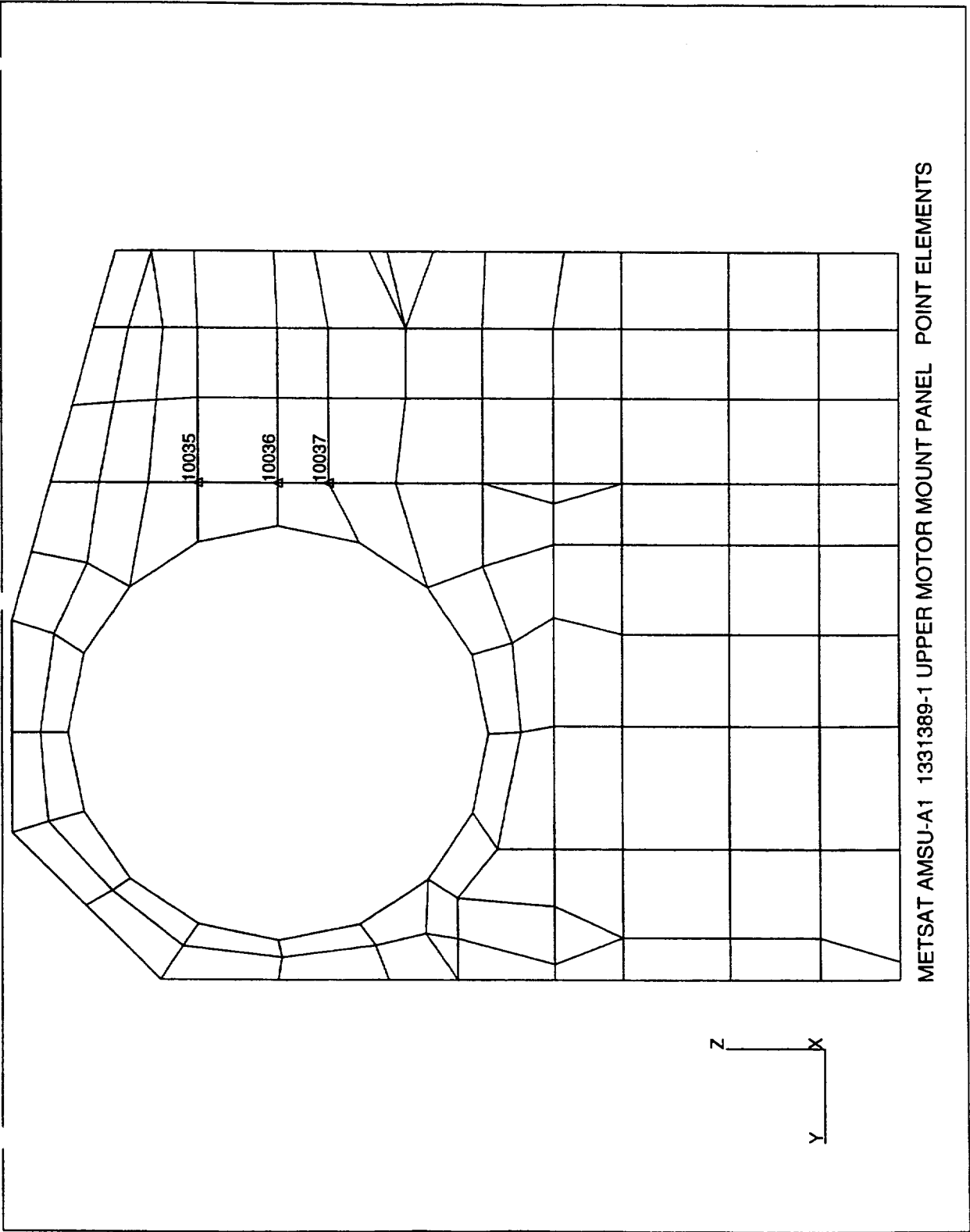


Figure A-14 METSAT AMSU-A1 1331389-1 Upper Motor Mount Panel Point Elements

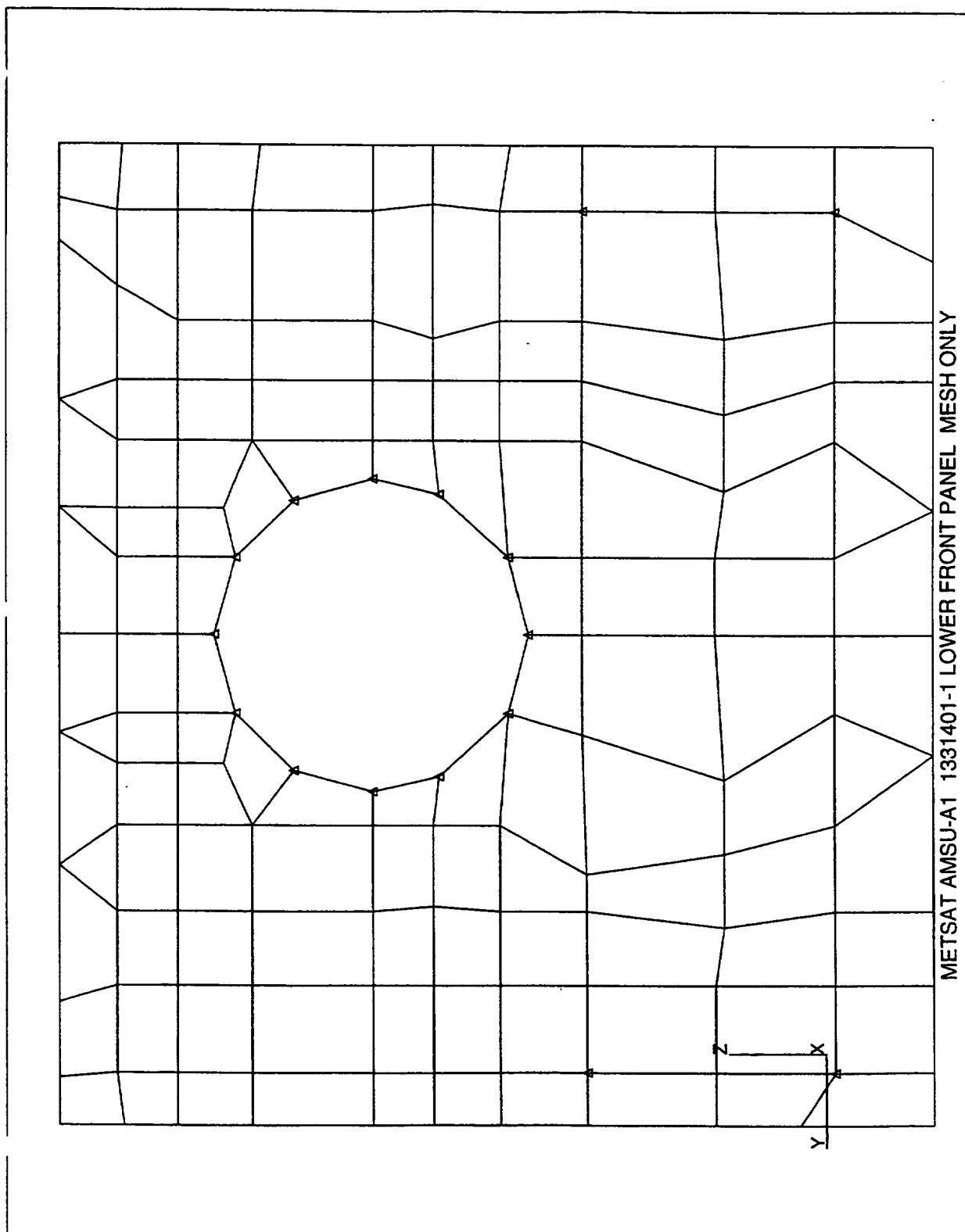


Figure A-15 METSAT AMSU-A1 1331401-1 Lower Front Panel Mesh Only

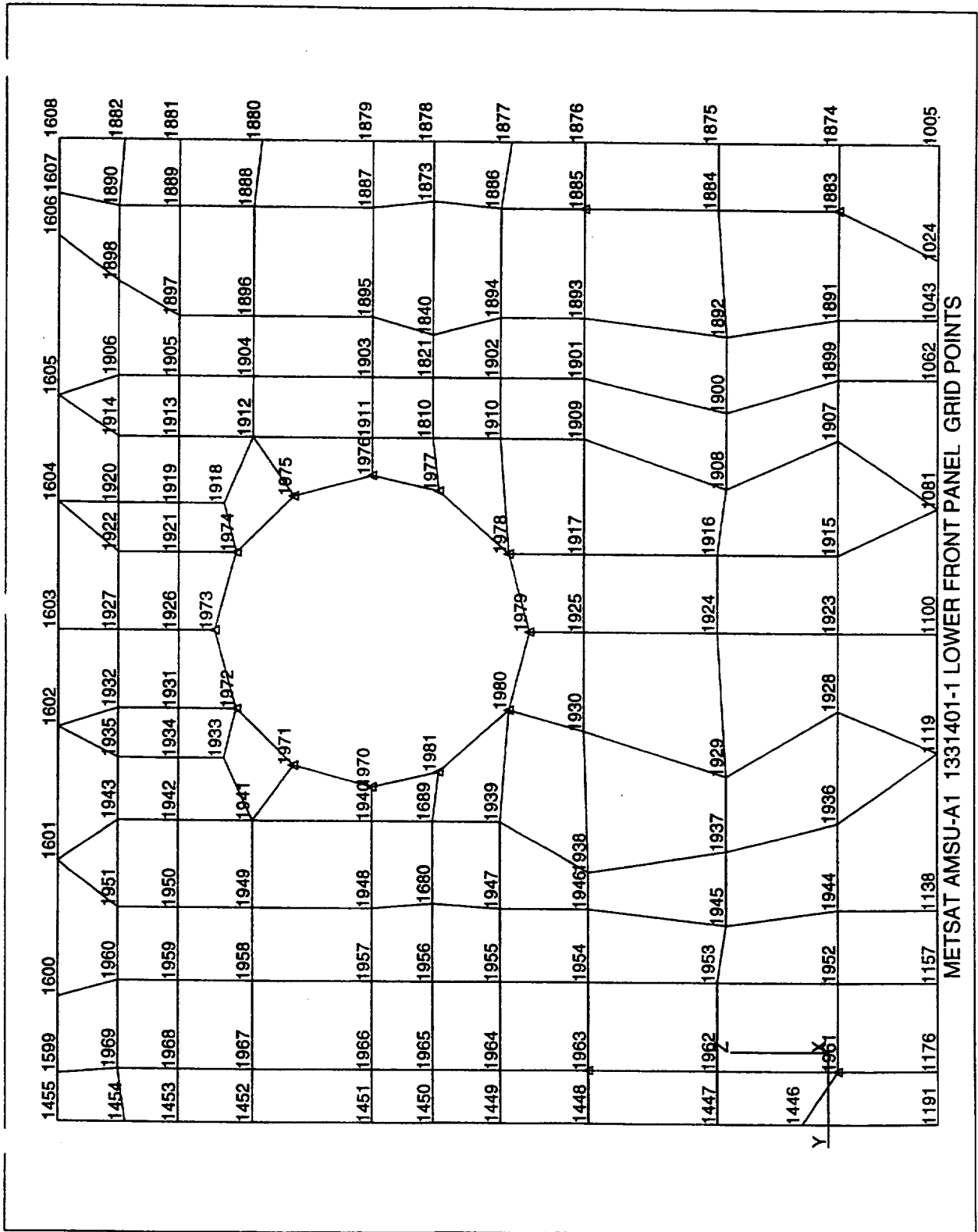


Figure A-16 METSAT AMSU-A1 1331401-1 Lower Front Panel Grid Points

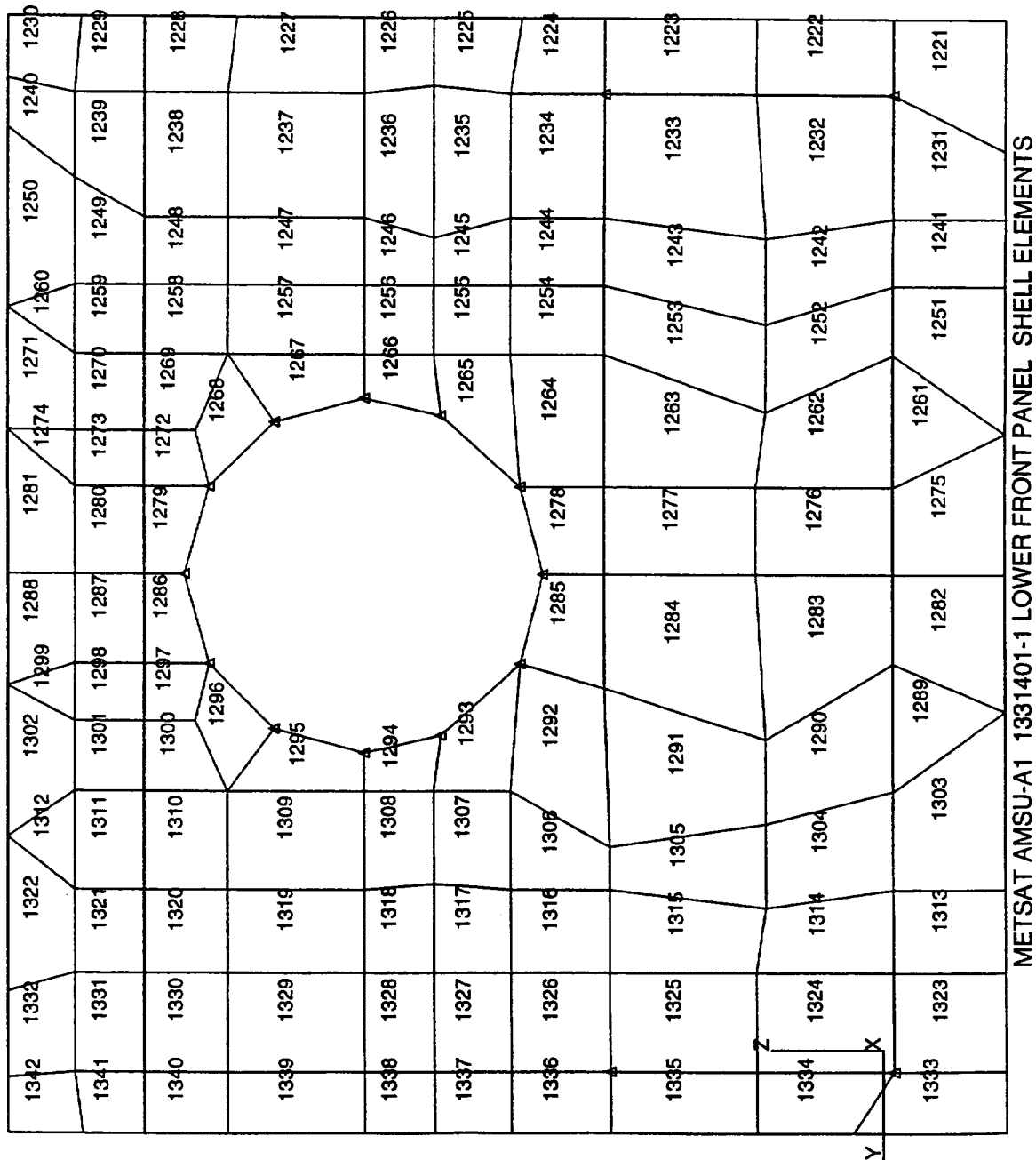


Figure A-17 METSAT AMSU-A1 1331401-1 Lower Front Panel Shell Elements

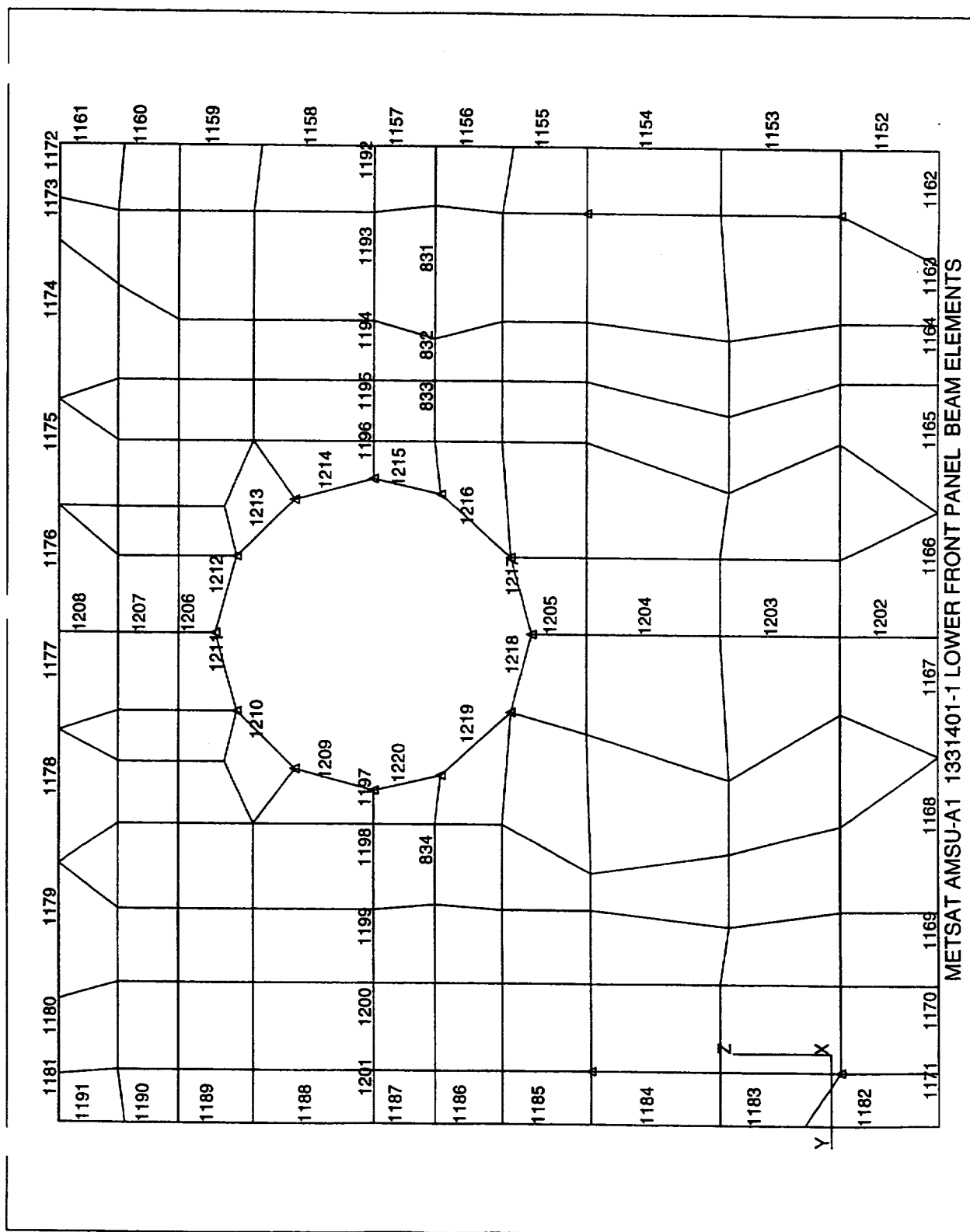


Figure A-18 METSAT AMSU-A1 1331401-1 Lower Front Panel Beam Elements

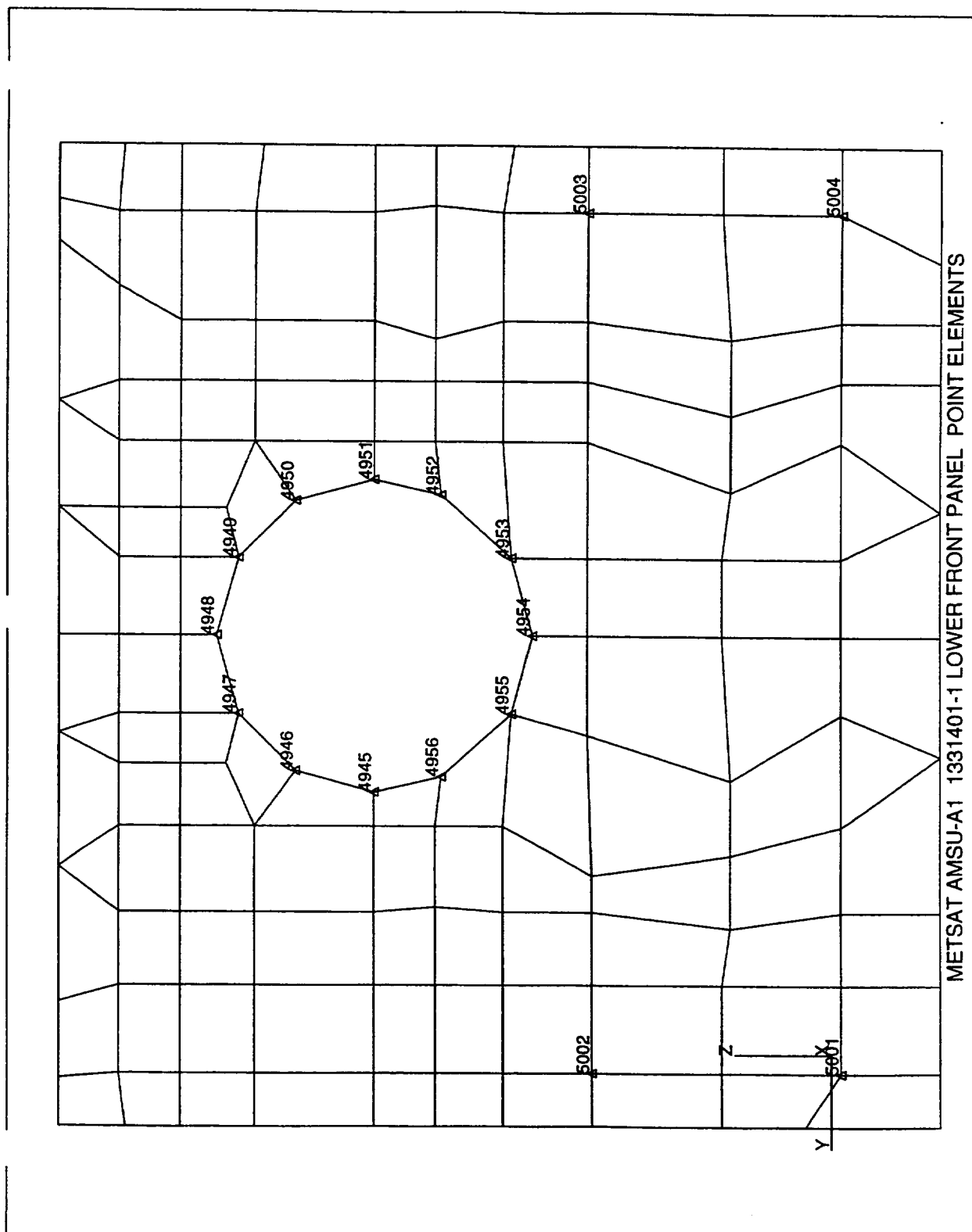


Figure A-19 METSAT AMSU-A1 1331401-1 Lower Front Panel Point Elements

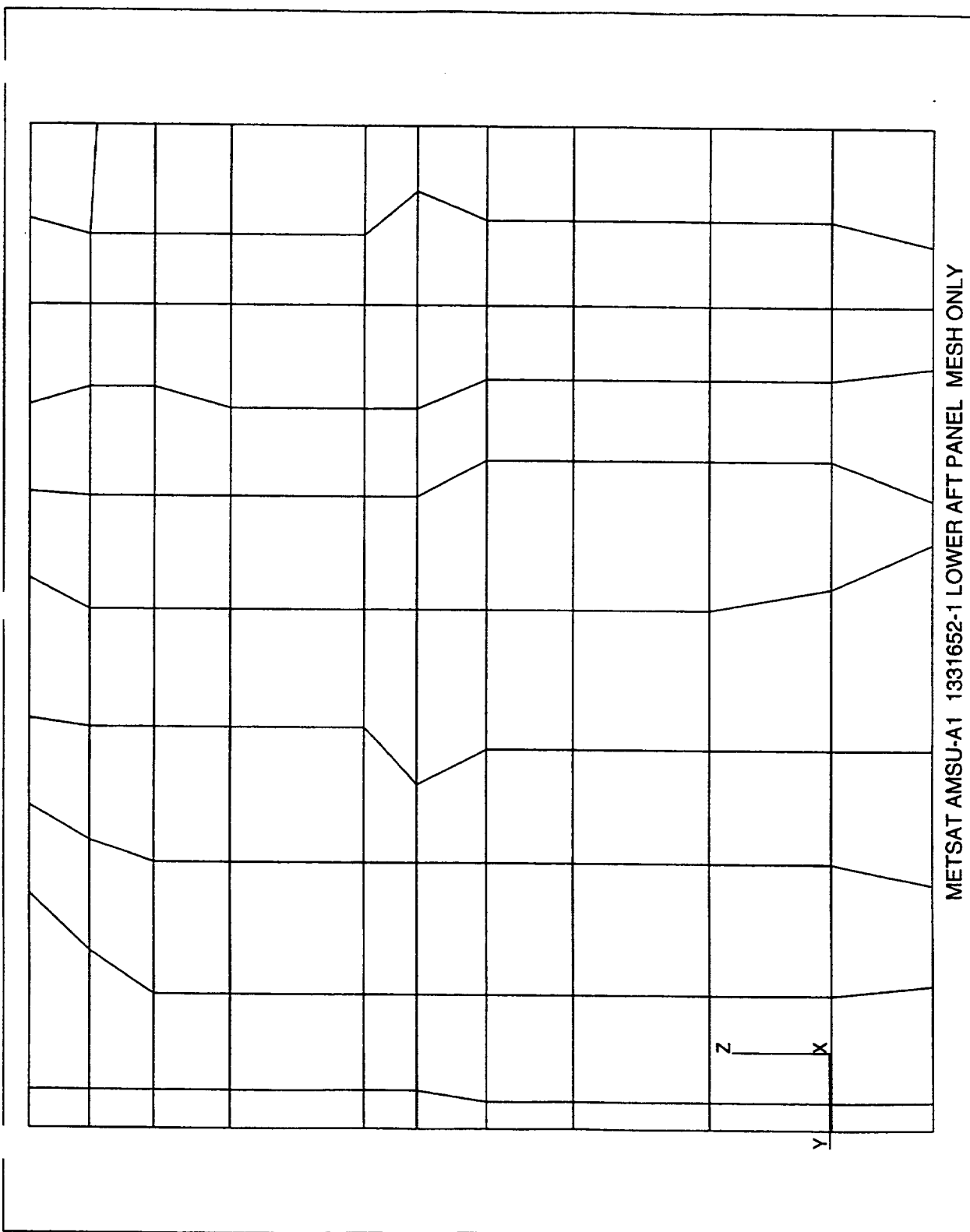


Figure A-20 METSAT AMSU-A1 1331652-1 Lower Aft Panel Mesh Only

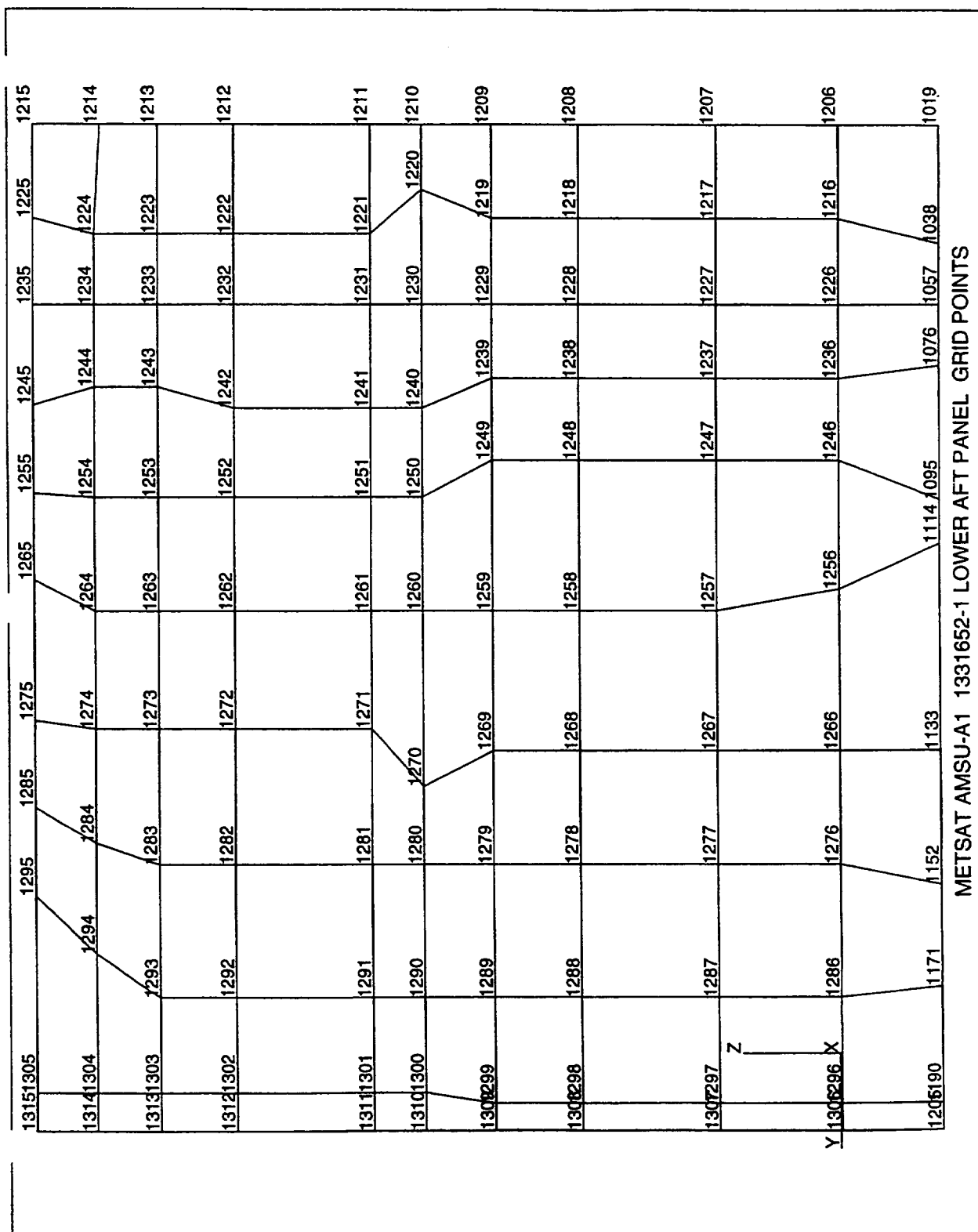


Figure A-21 METSAT AMSU-A1 1331652-1 Lower Aft Panel Grid Points

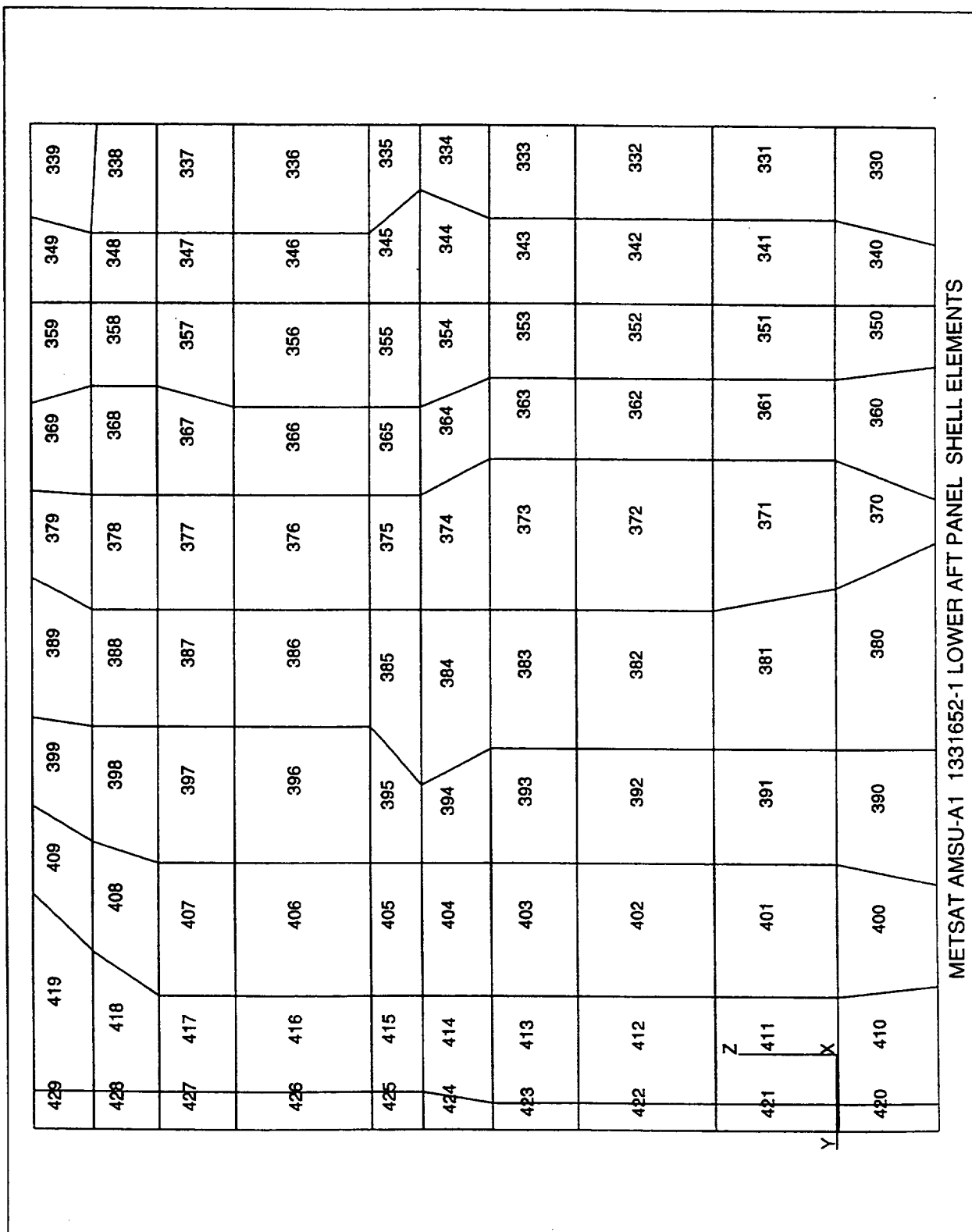


Figure A-22 METSAT AMSU-A1 1331652-1 Lower Aft Panel Shell Elements

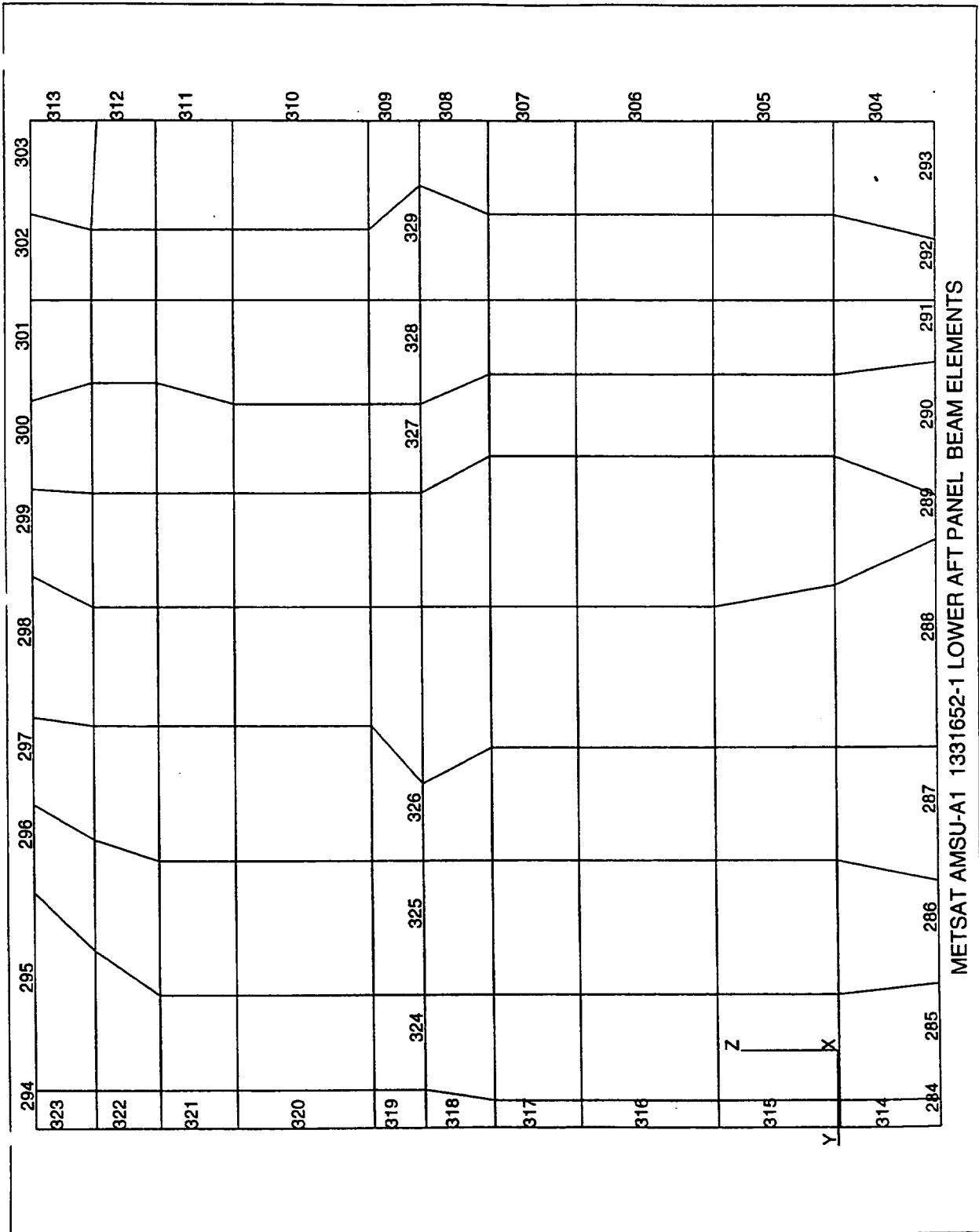


Figure A-23 METSAT AMSU-A1 1331652-1 Lower Aft Panel Beam Elements

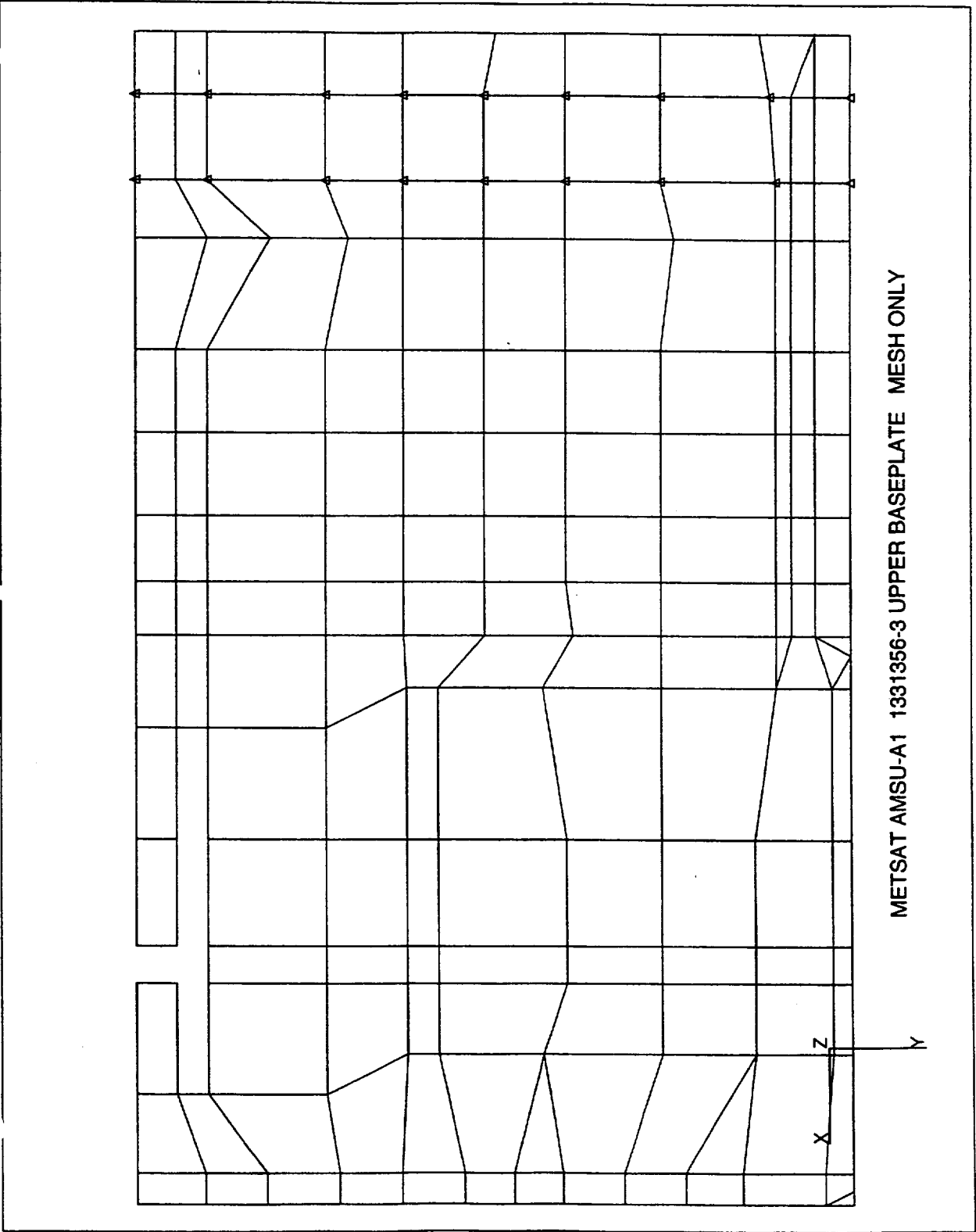


Figure A-24 METSAT AMSU-A1 1331356-3 Upper Baseplate Mesh Only

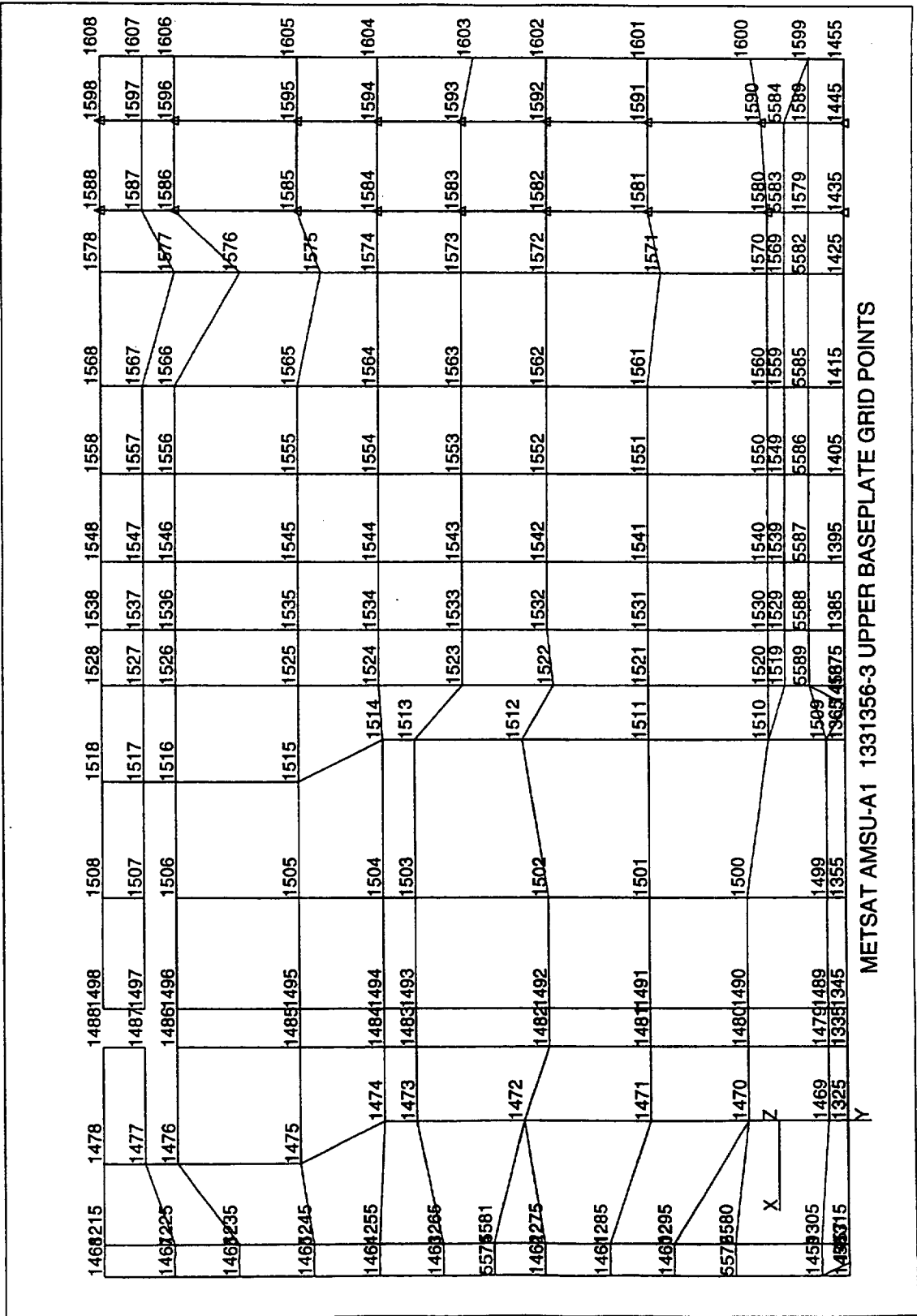


Figure A-25 METSAT AMSU-A1 1331356-3 Upper Baseplate Grid Points

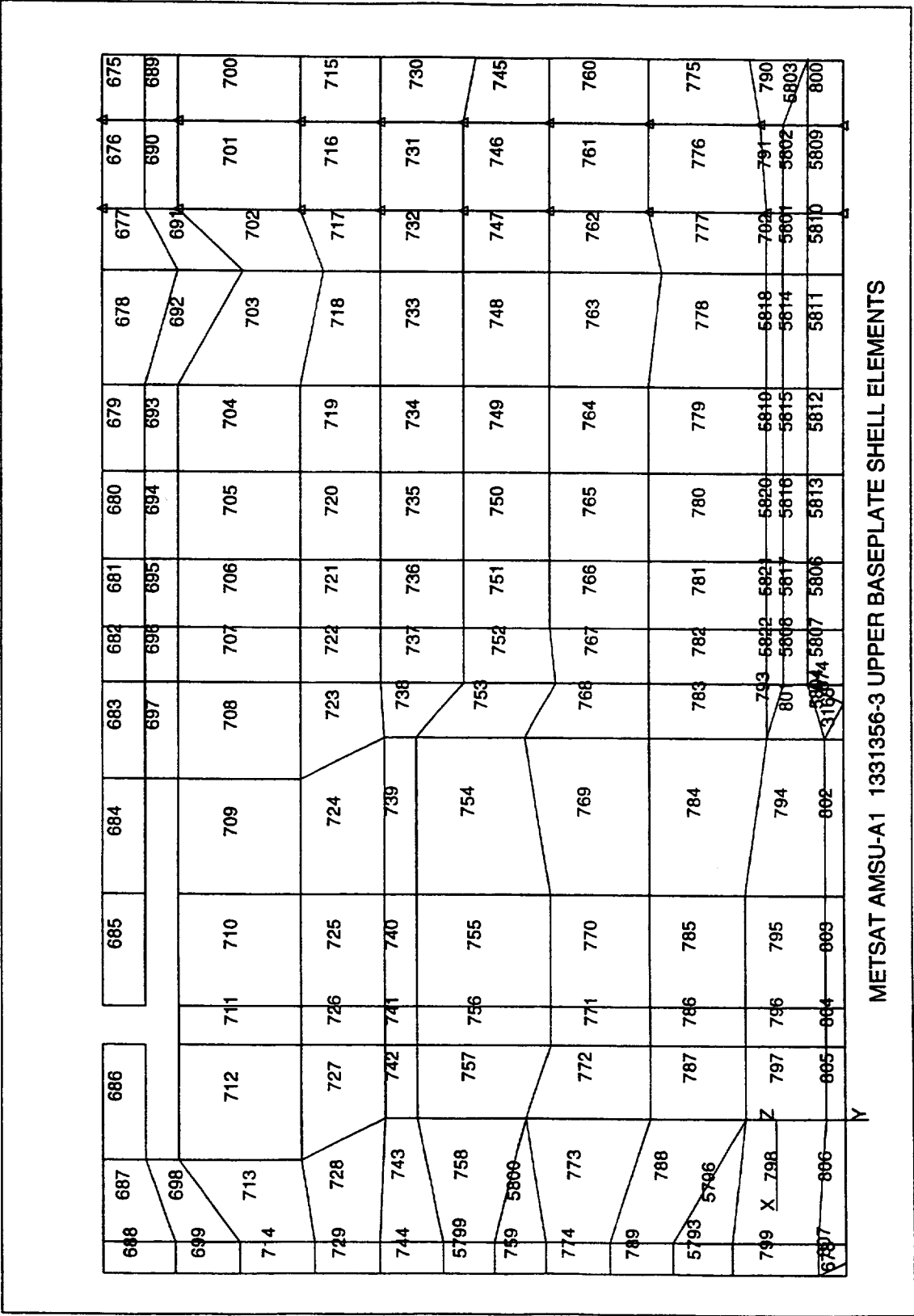


Figure A-26 METSAT AMSU-A1 1331356-3 Upper Baseplate Shell Elements

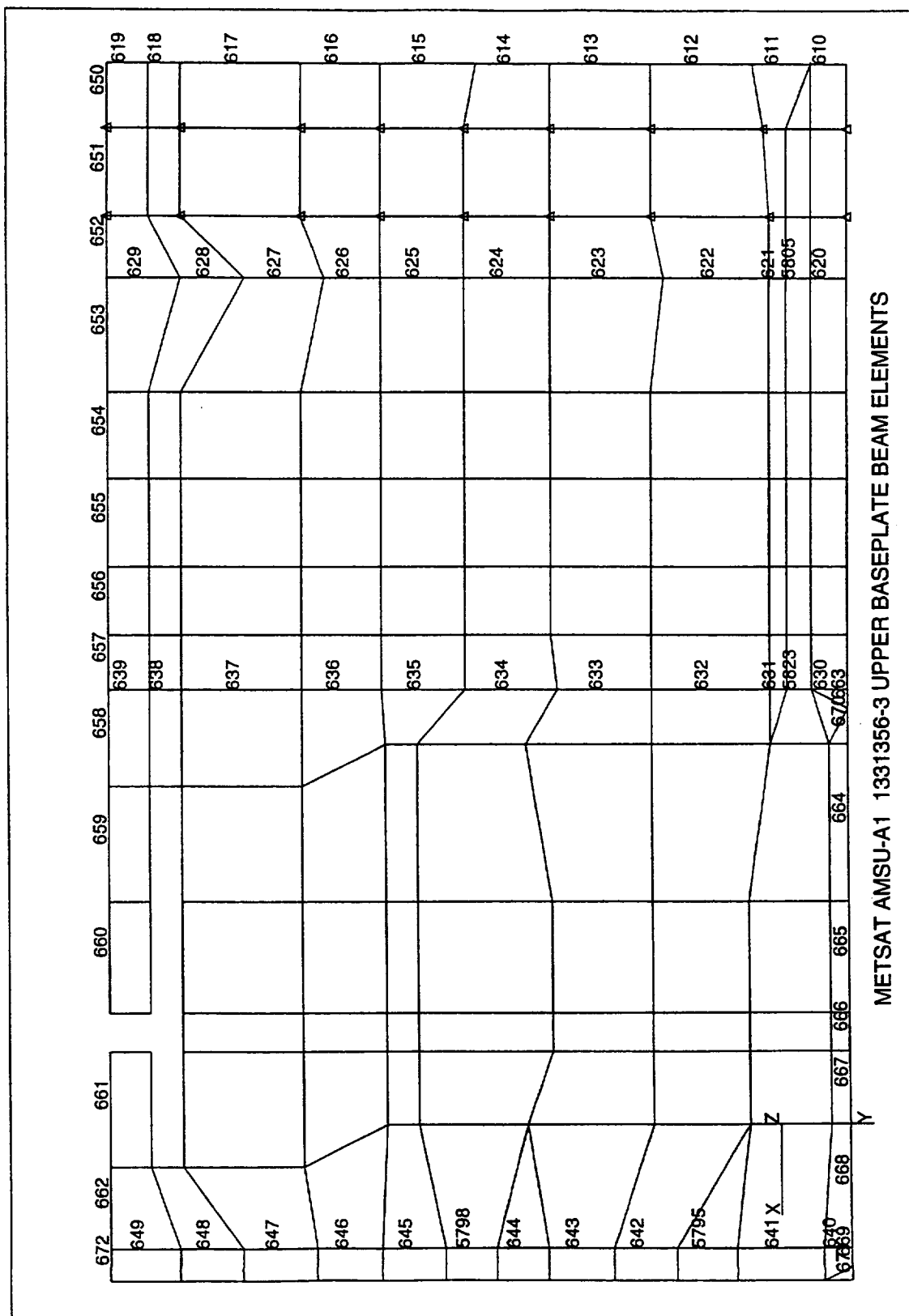


Figure A-27 METSAT AMSU-A1 1331356-3 Upper Baseplate Beam Elements

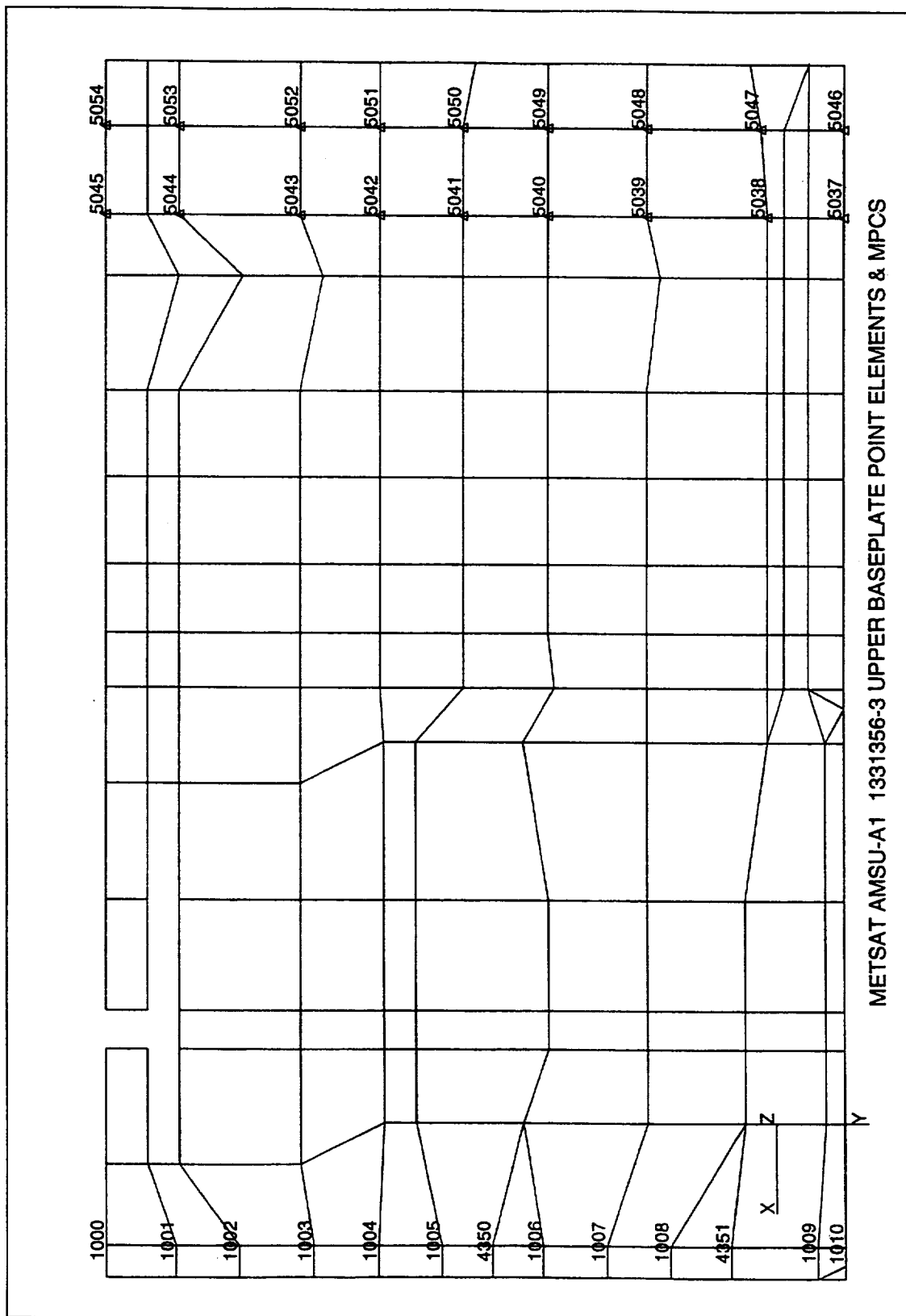


Figure A-28 METSAT AMSU-A1 1331356-3 Upper Baseplate Point Elements & MPCs

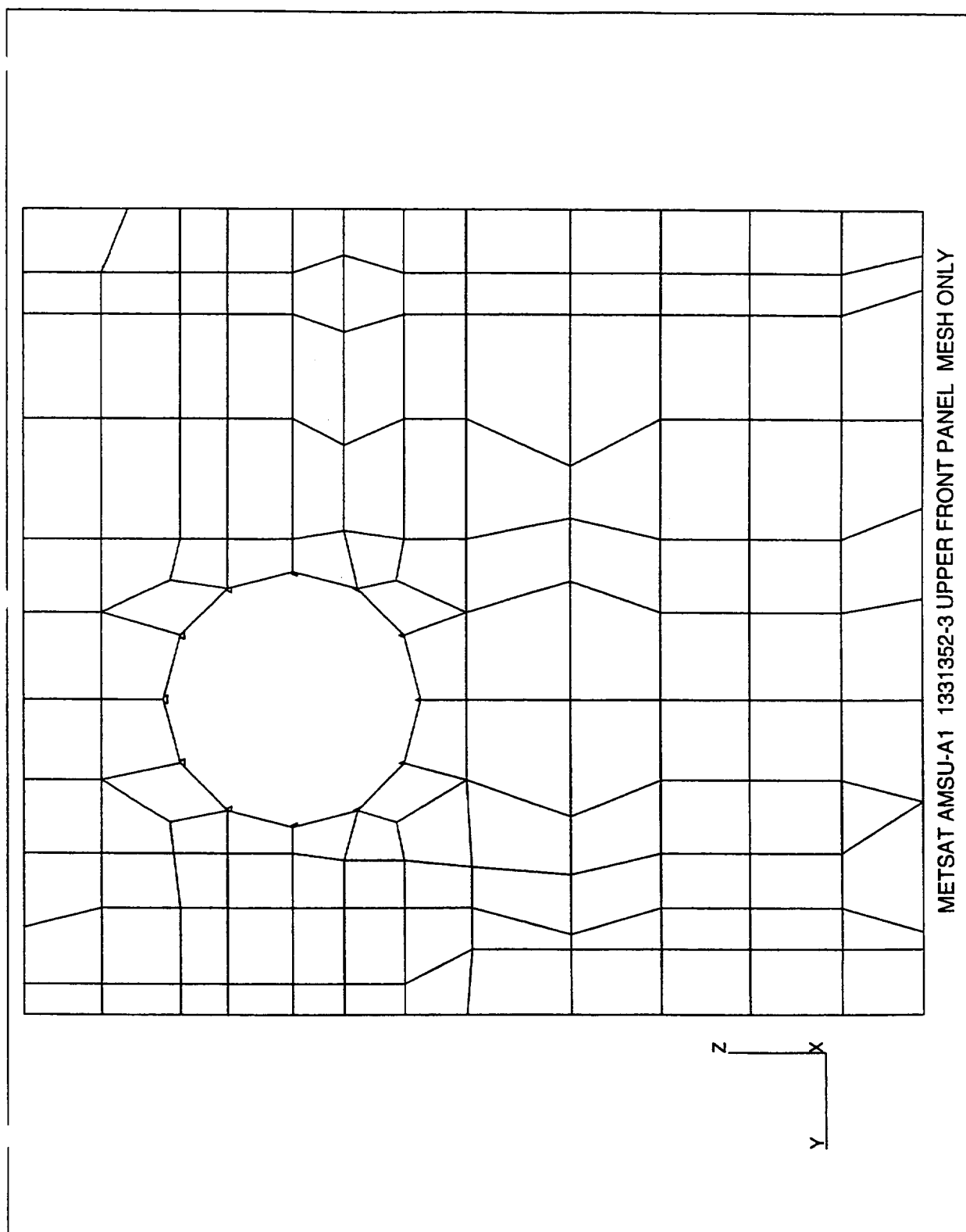


Figure A-29 METSAT AMSU-A1 1331352-3 Upper Front Panel Mesh Only

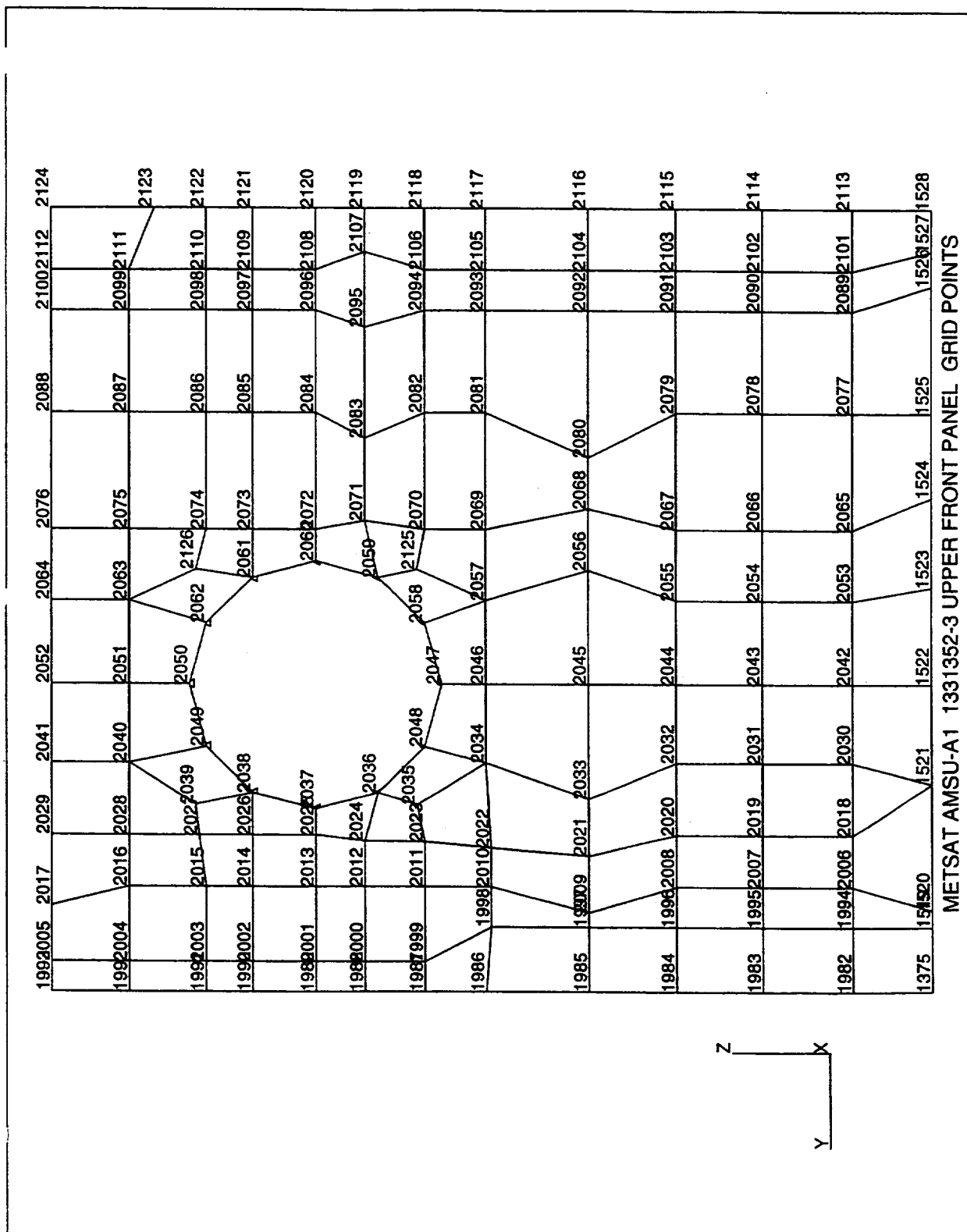


Figure A-30 METSAT AMSU-A1 1331352-3 Upper Front Panel Grid Points

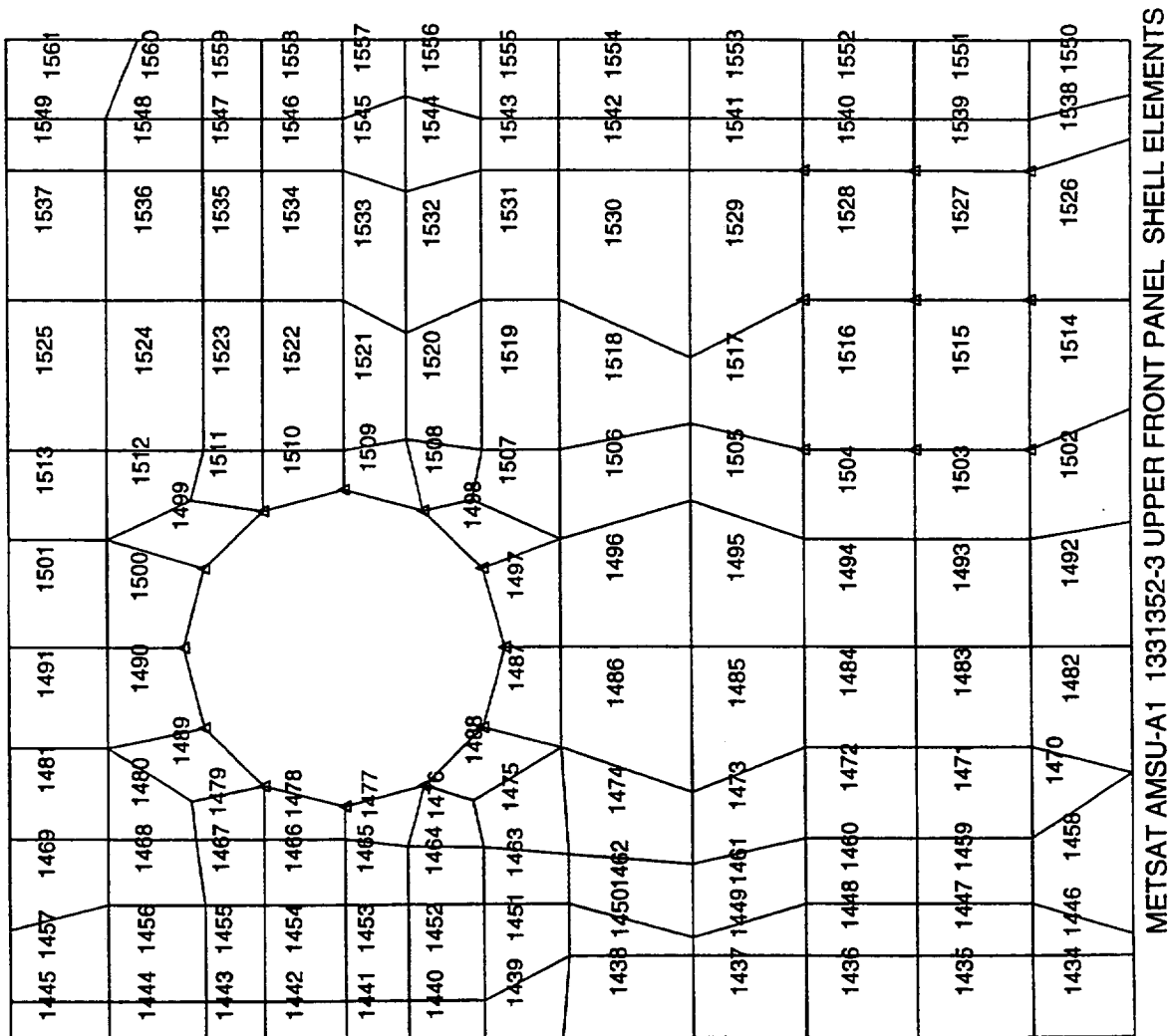


Figure A-31 METSAT AMSU-A1 1331352-3 Upper Front Panel Shell Elements

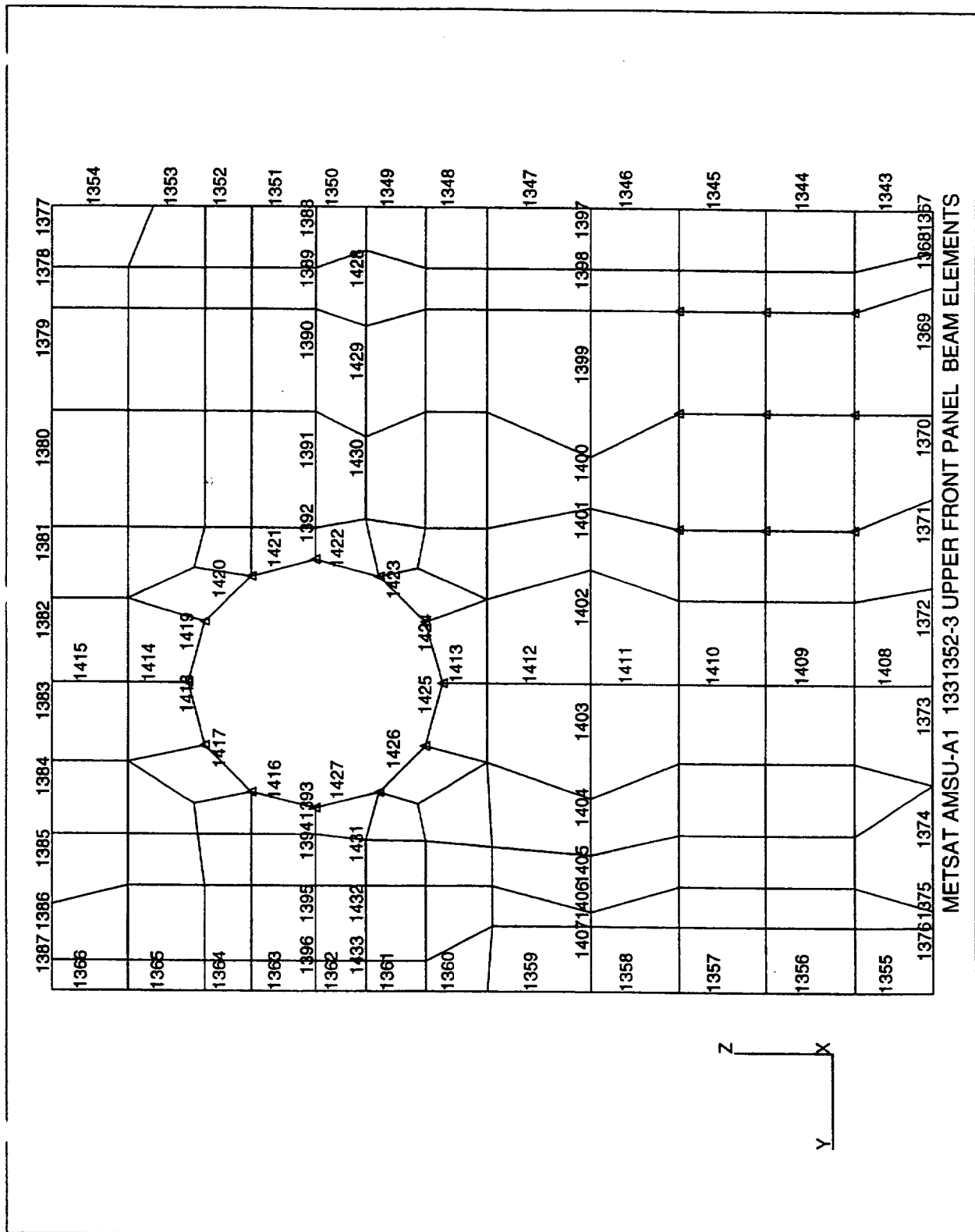


Figure A-32 METSAT AMSU-A1 1331352-3 Upper Front Panel Beam Elements

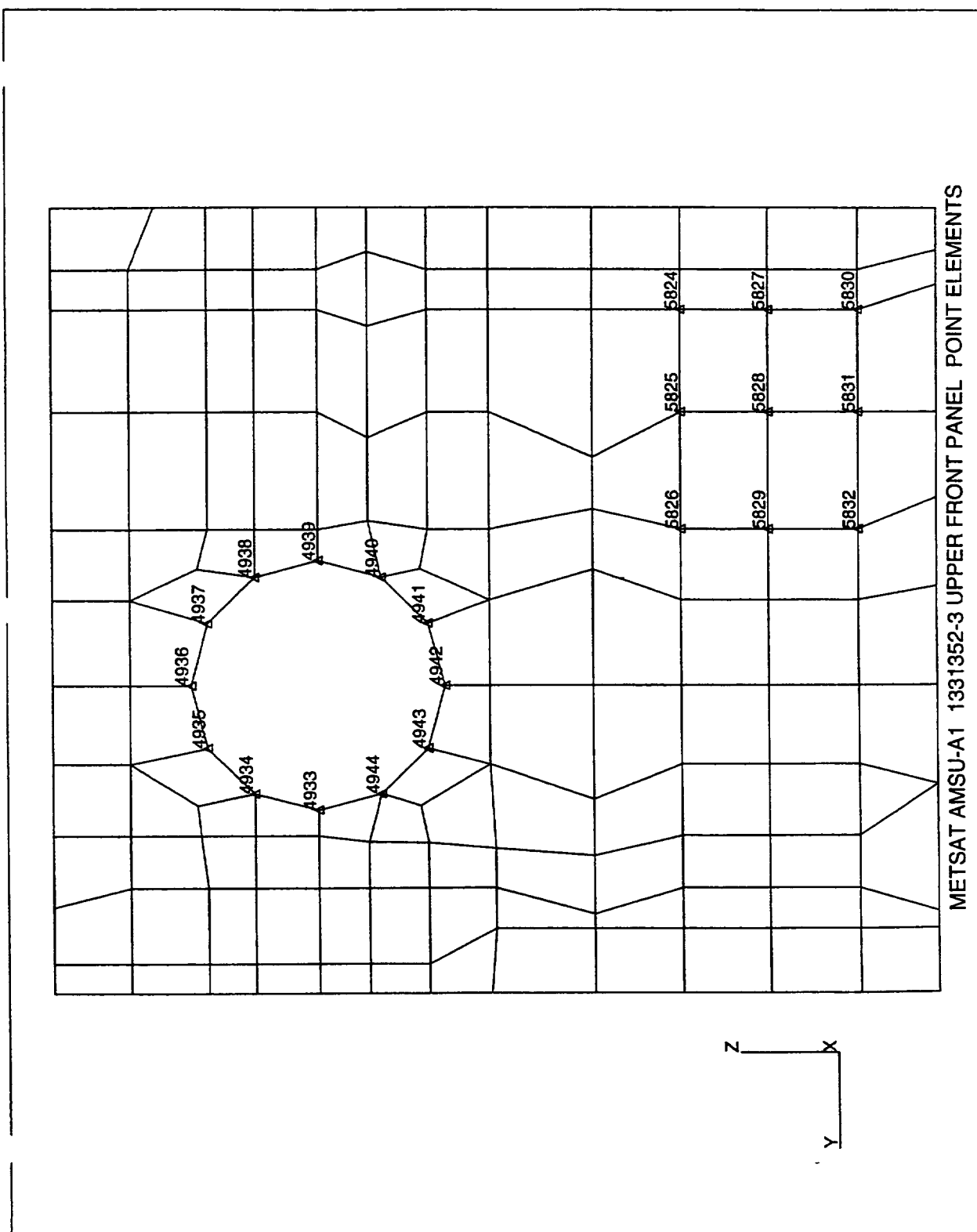


Figure A-33 METSAT AMSU-A1 1331352-3 Upper Front Panel Point Elements

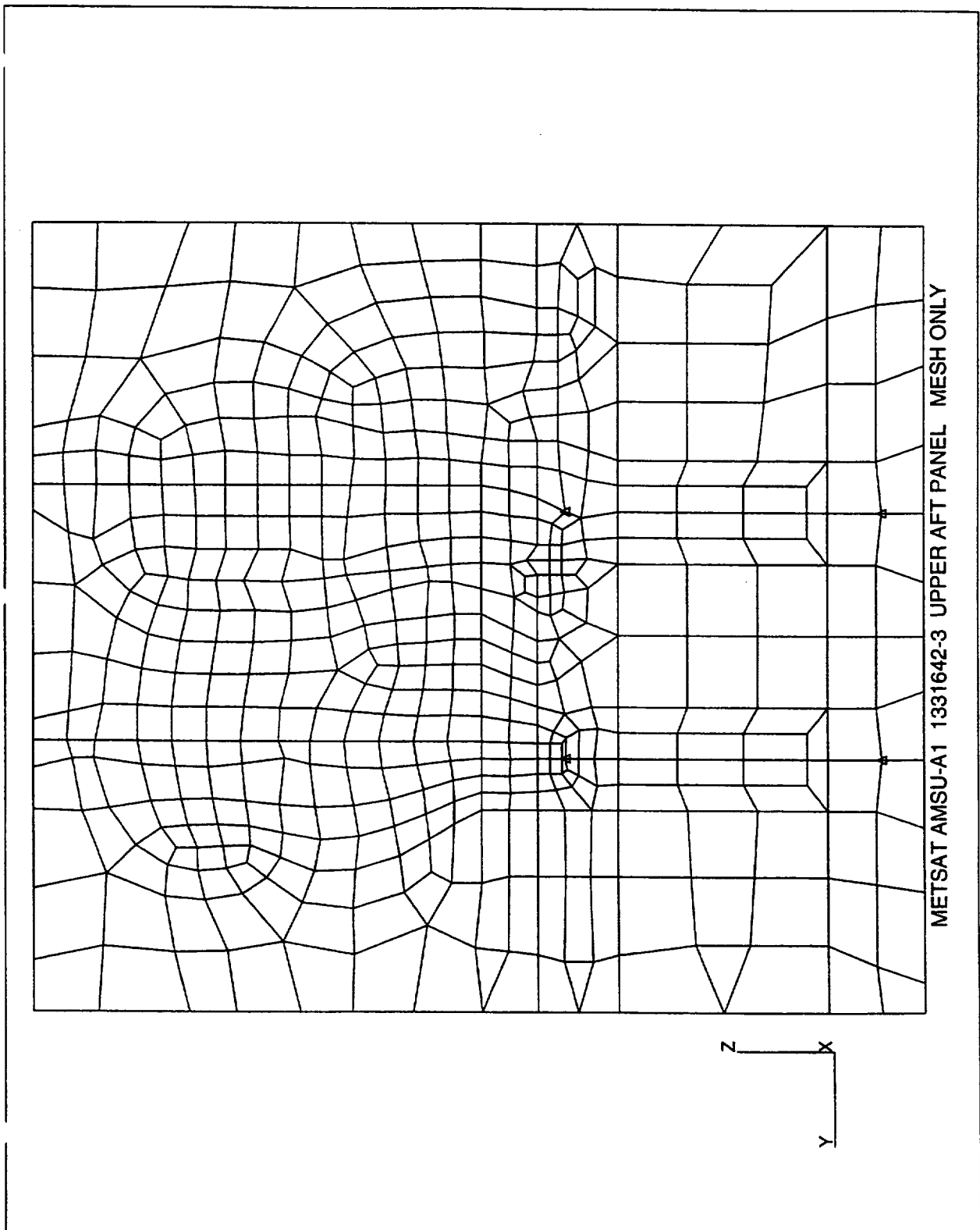


Figure A-34 METSAT AMSU-A1 1331642-3 Upper Aft Panel Mesh Only

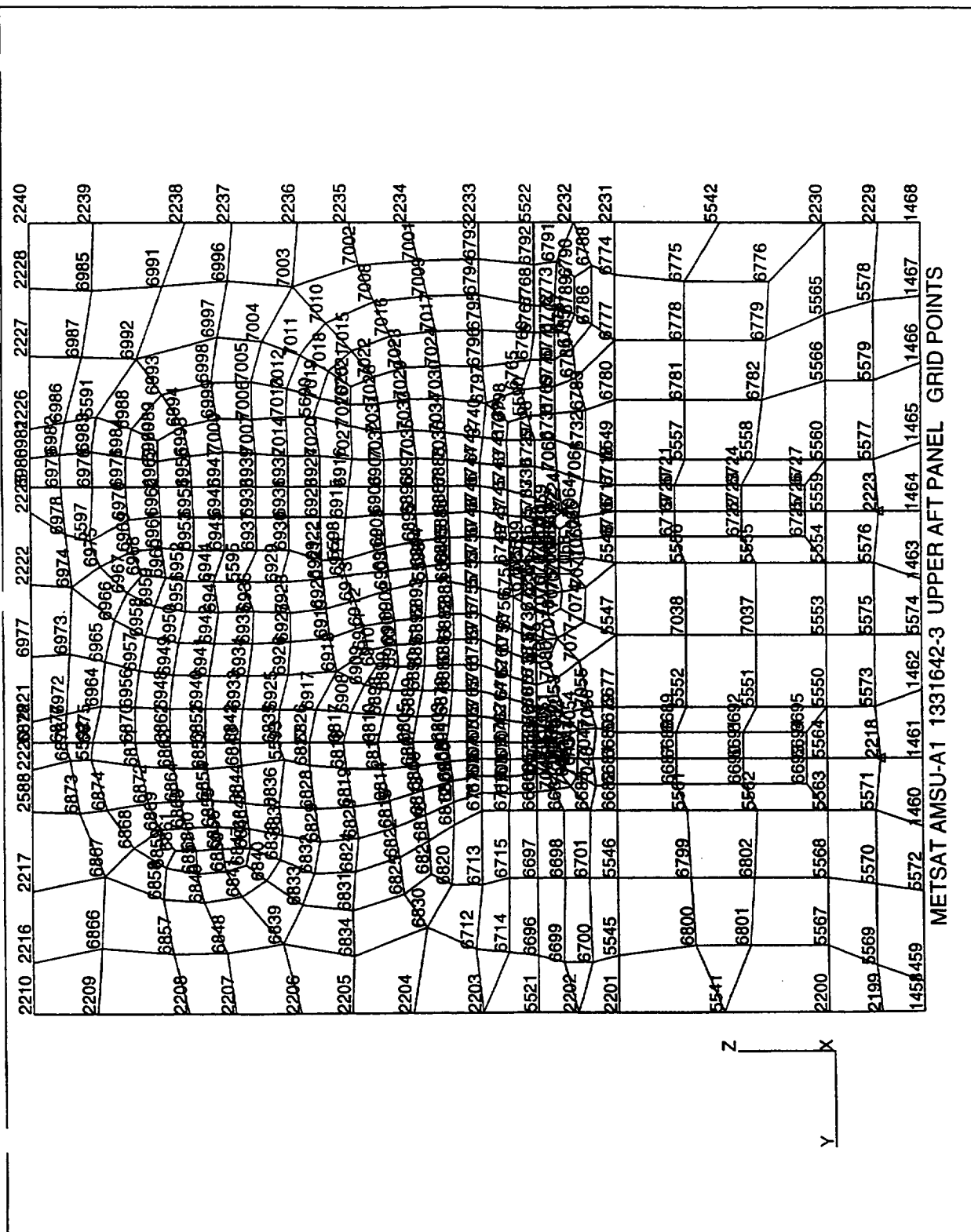


Figure A-35 METSAT AMSU-A1 1331642-3 Upper Aft Panel Grid Points

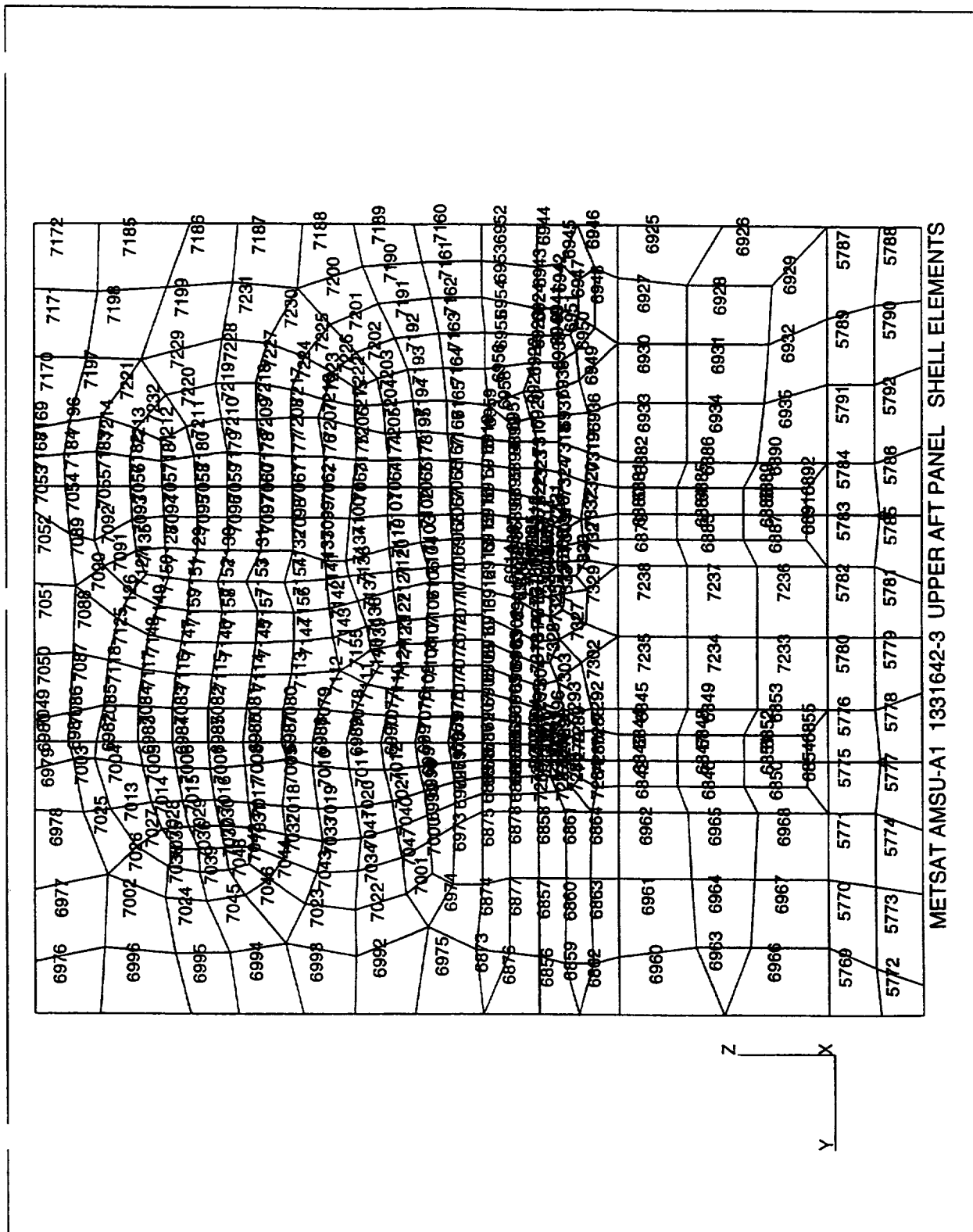


Figure A-36 METSAT AMSU-A1 1331642-3 Upper Aft Panel Shell Elements

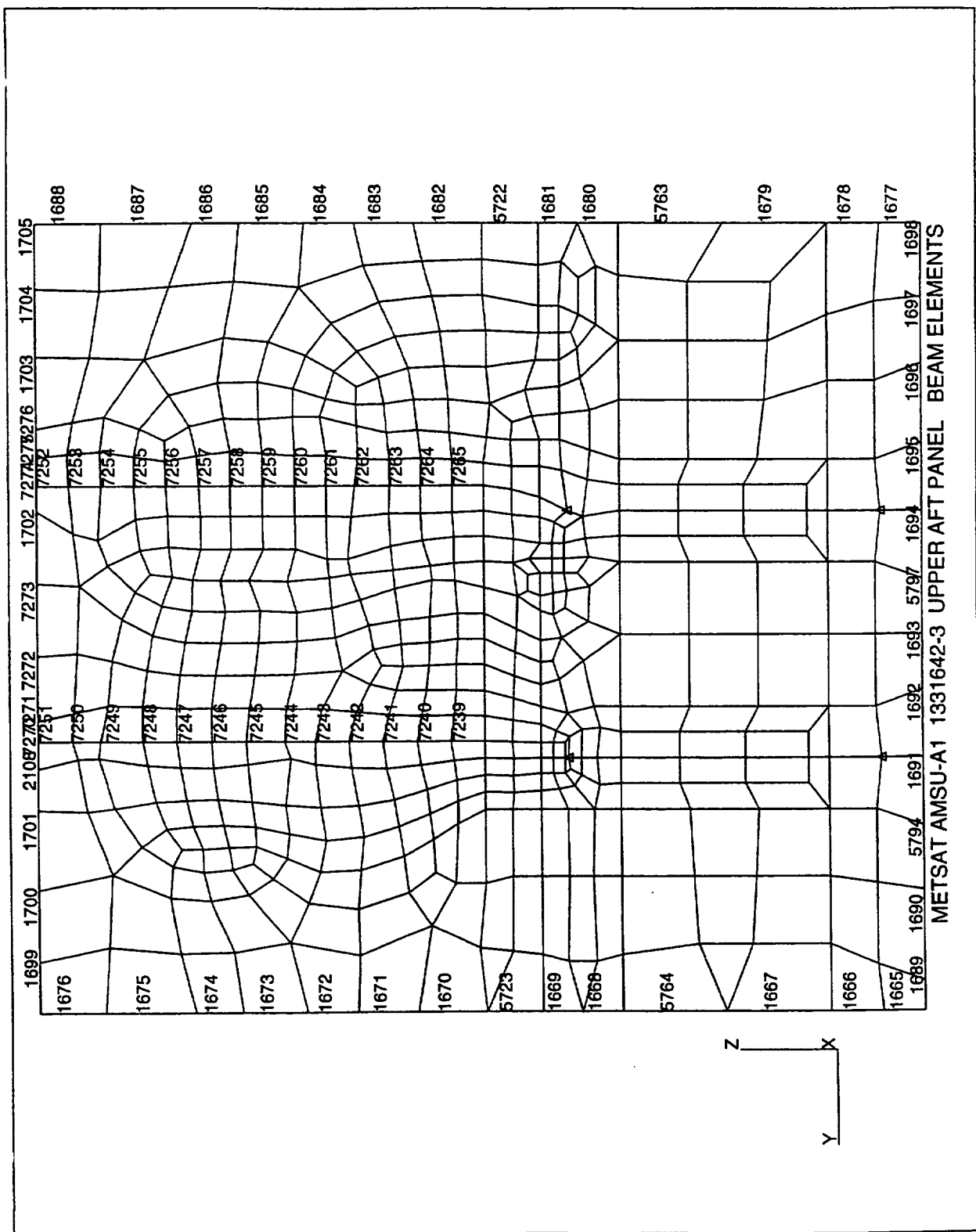


Figure A-37 METSAT AMSU-A1 1331642-3 Upper Aft Panel Beam Elements

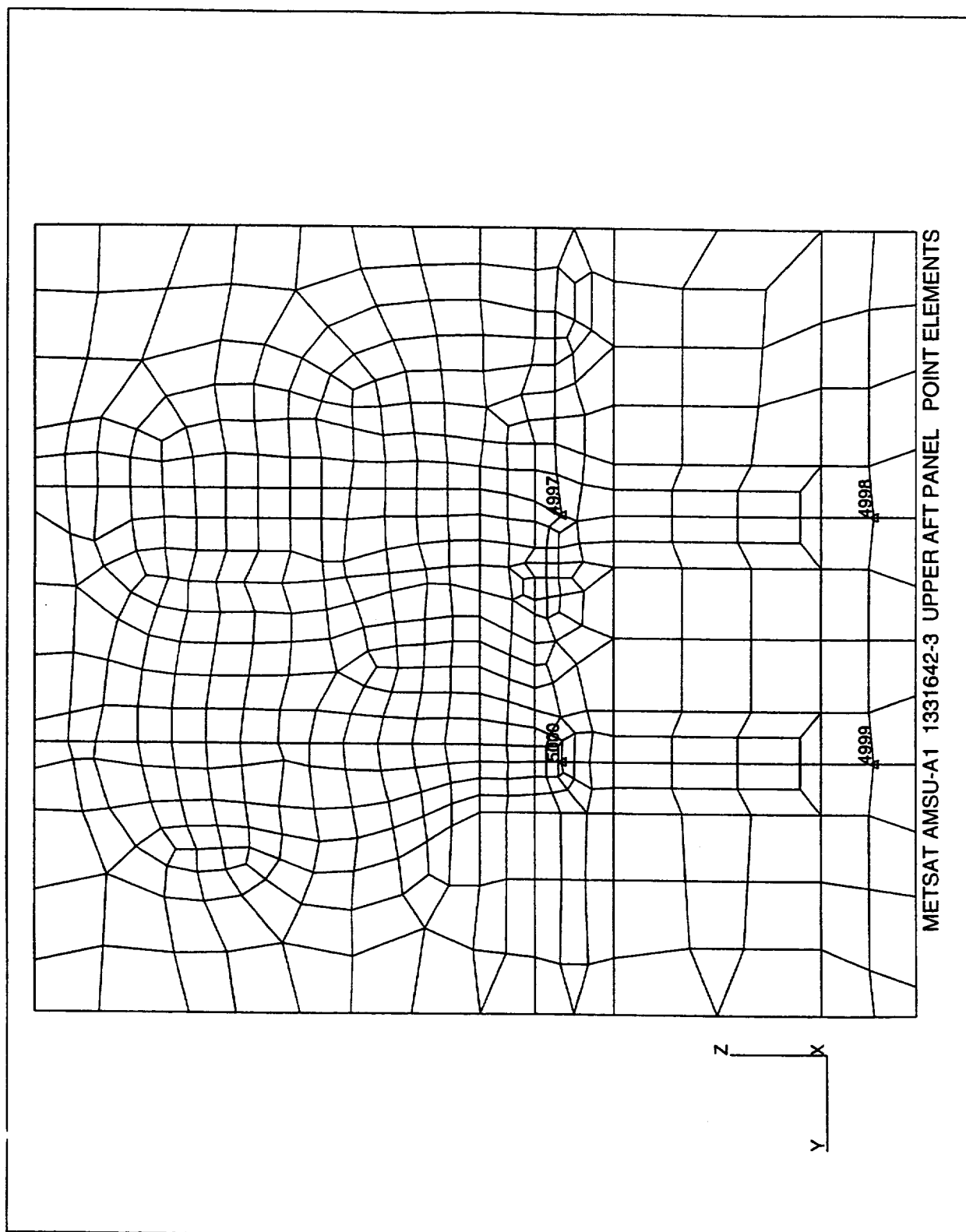


Figure A-38 METSAT AMSU-A1 1331642-3 Upper Aft Panel Point Elements

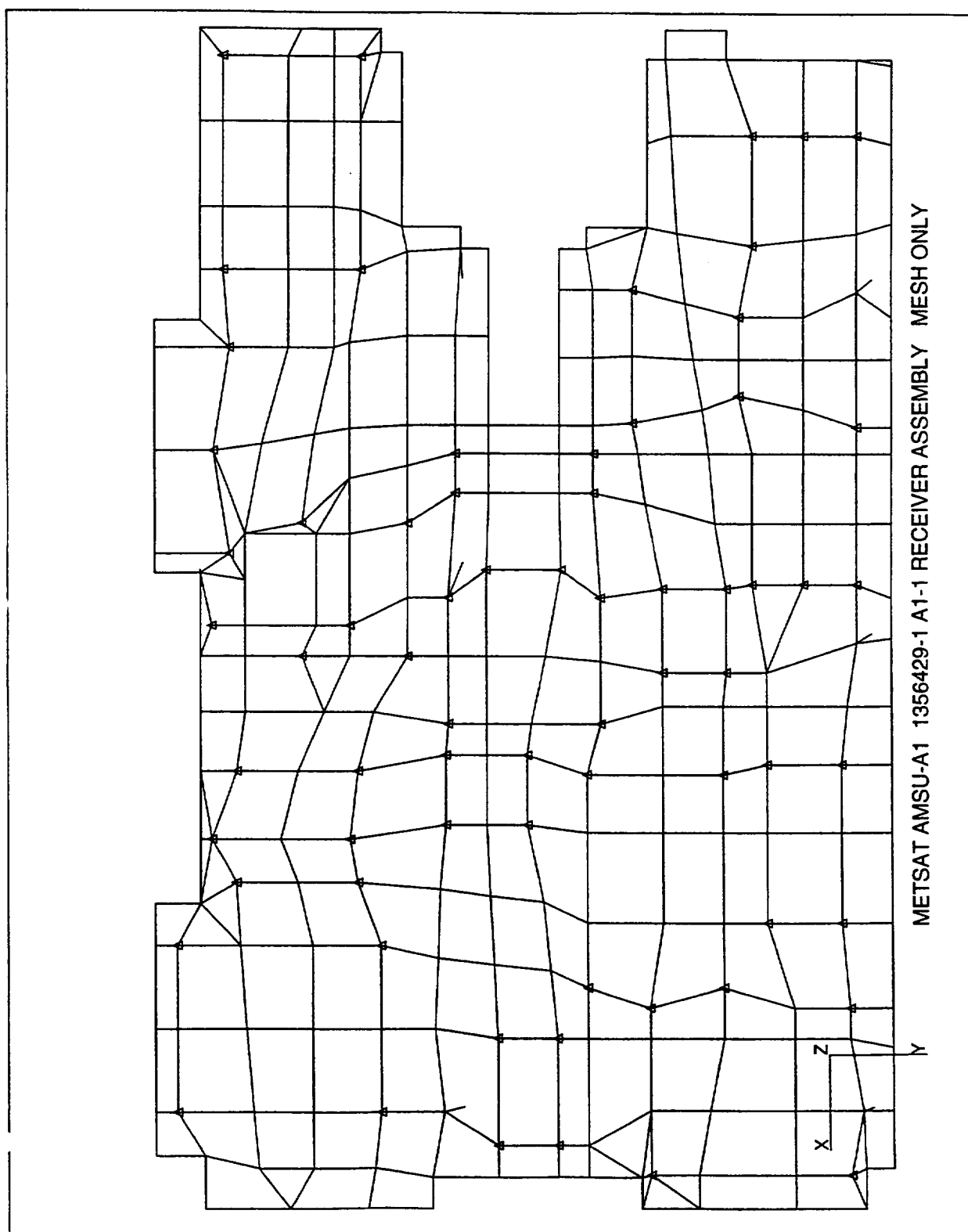


Figure A-39 METSAT AMSU-A1 1356429-1 A1-1 Receiver Assembly Mesh Only

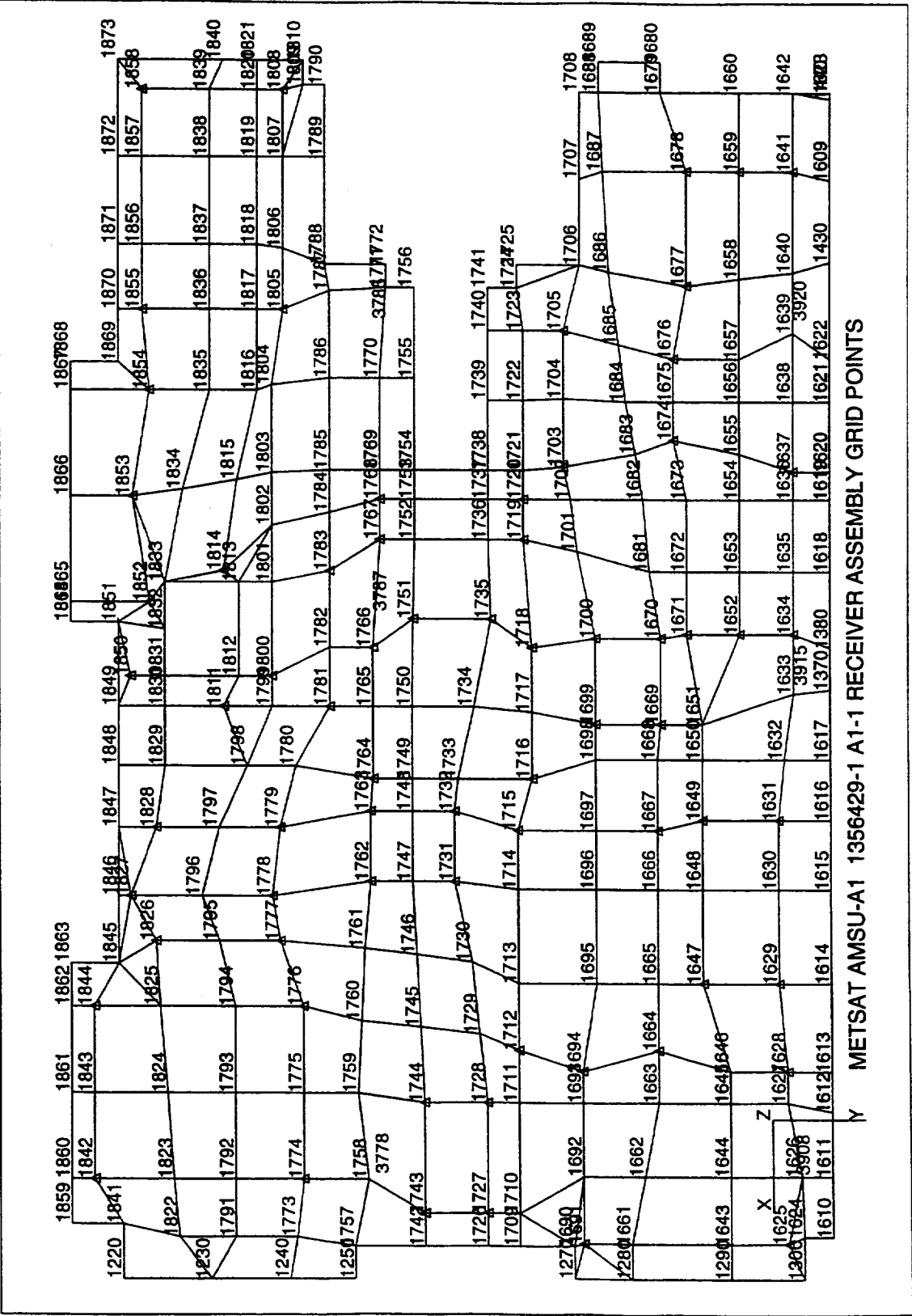


Figure A-40 METSAT AMSU-A1 1356429-1 A1-1 Receiver Assembly Grid Points

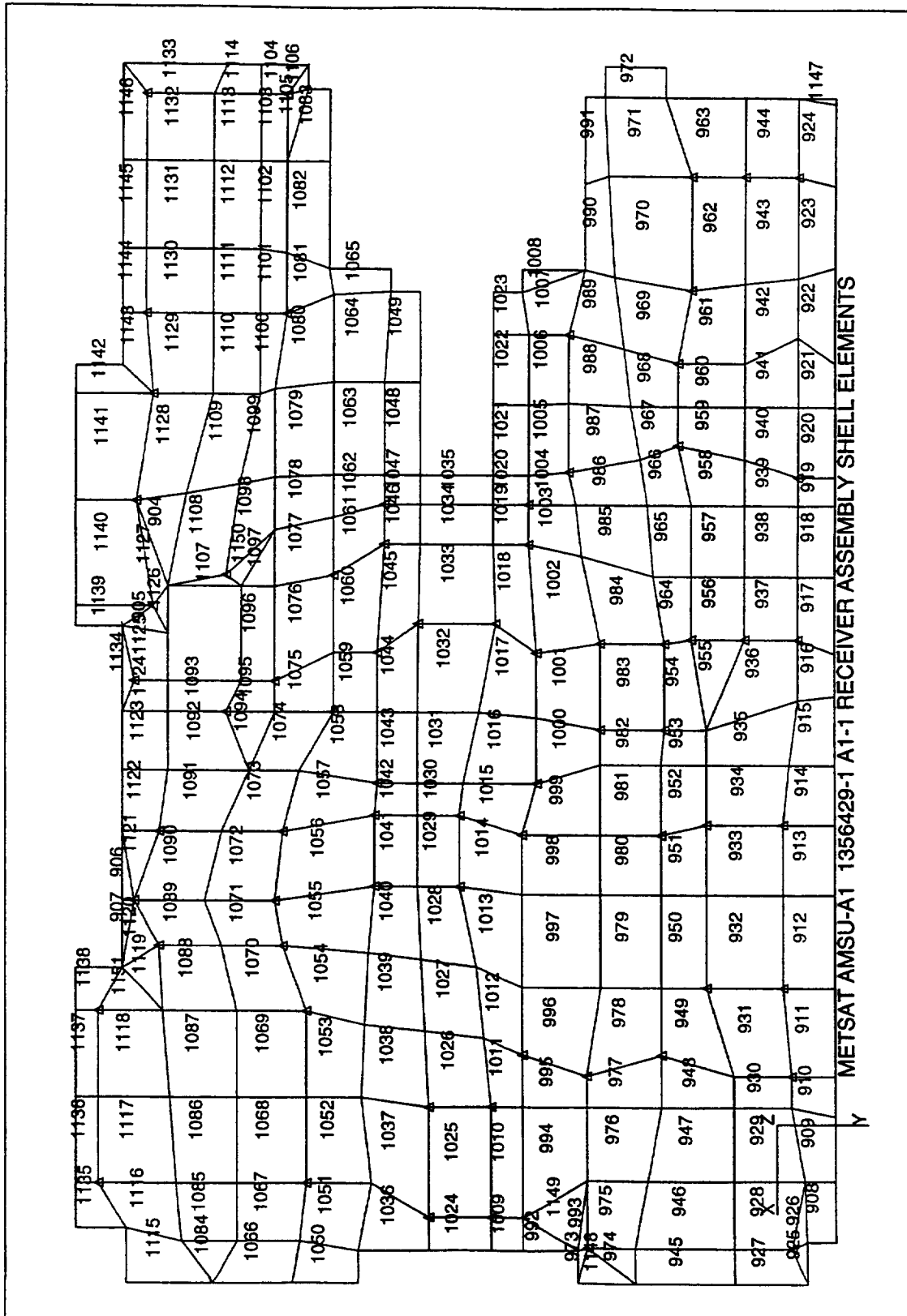


Figure A-41 METSAT AMSU-A1 1356429-1 A1-1 Receiver Assembly Shell Elements

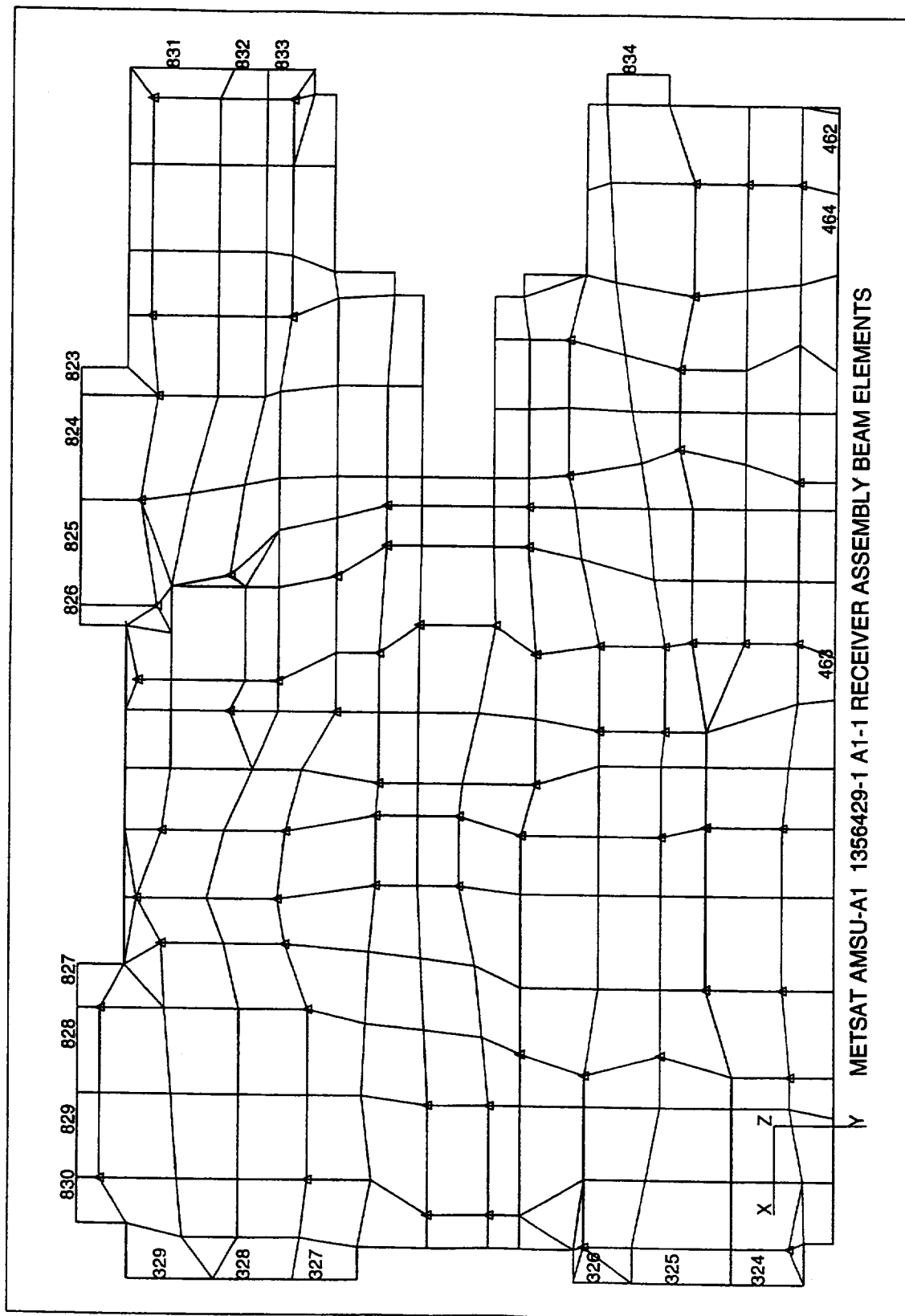


Figure A-42 METSAT AMSU-A1 1356429-1 A1-1 Receiver Assembly Beam Elements

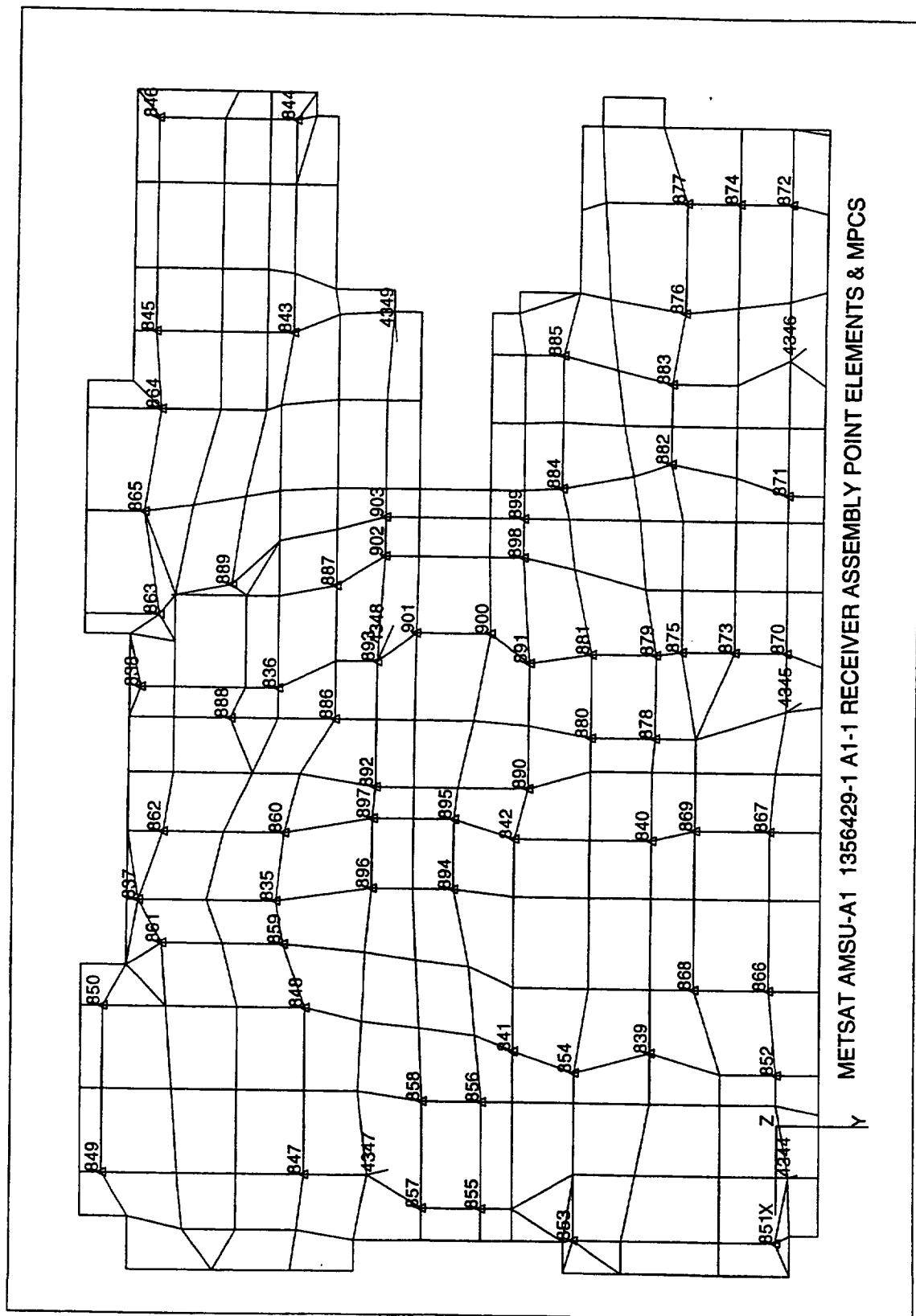


Figure A-43 METSAT AMSU-A1 1356429-1 A1-1 Receiver Assembly Point Elements & MPCS

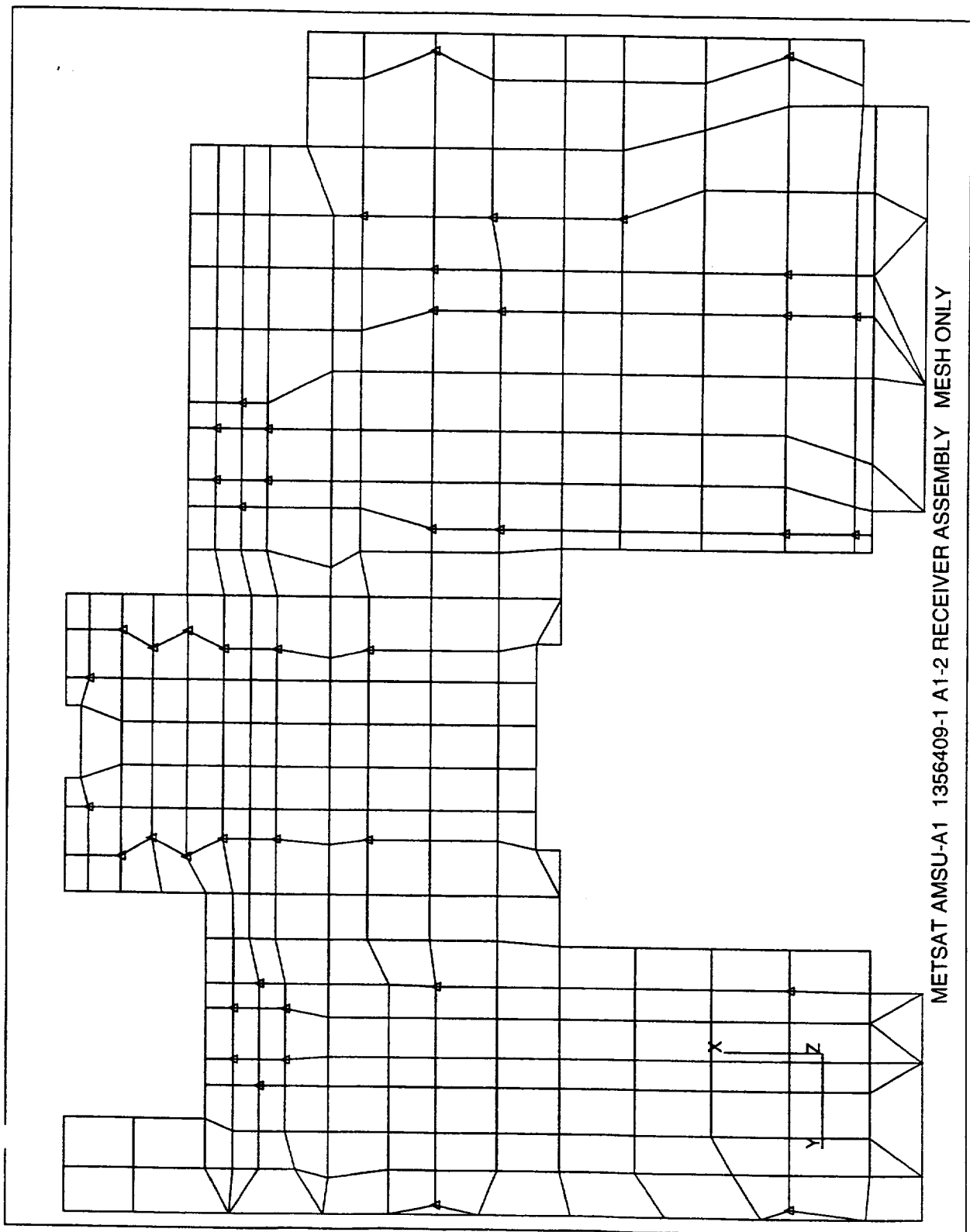


Figure A-44 METSAT AMSU-A1 1356409-1 A1-2 Receiver Assembly Mesh Only

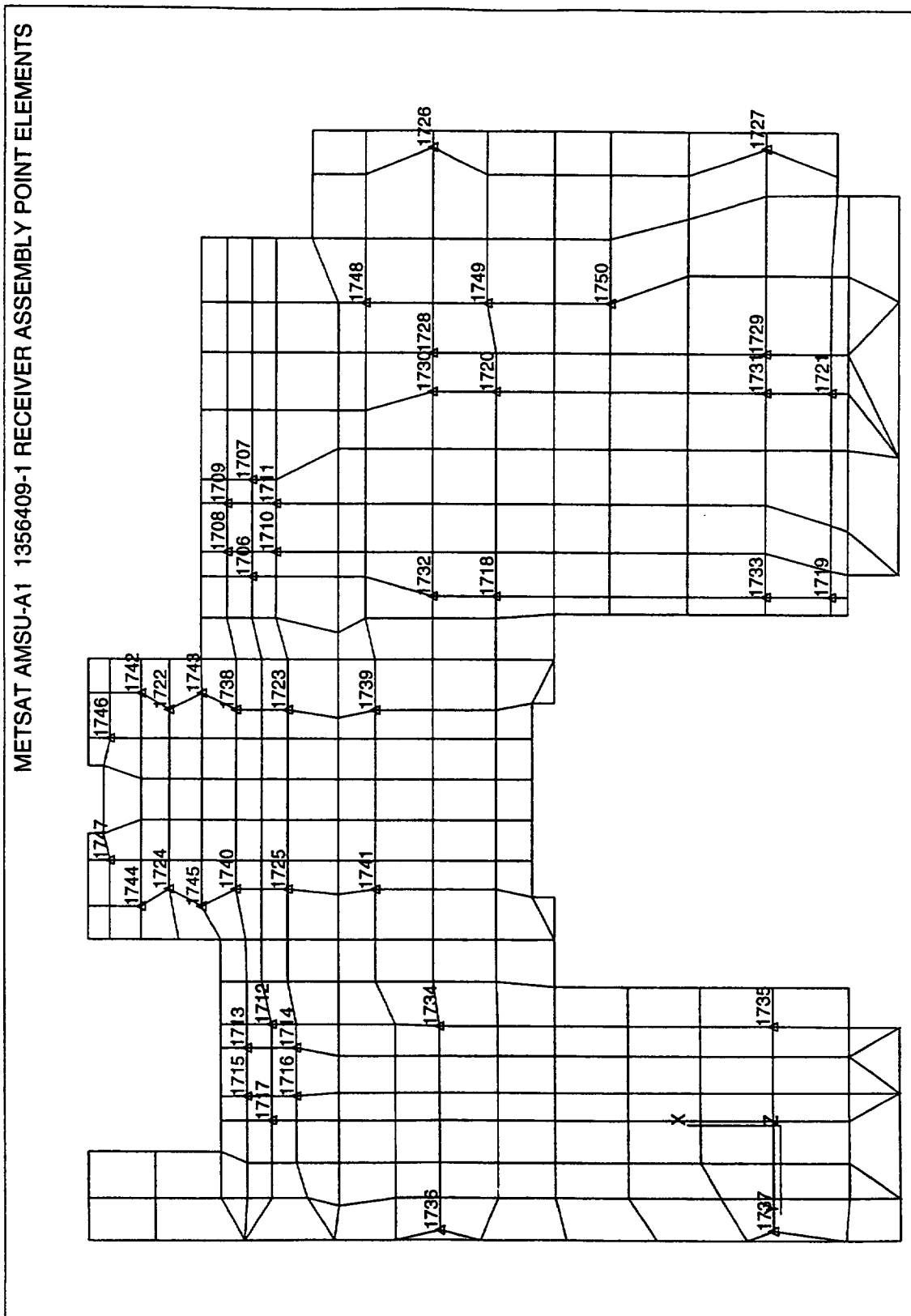


Figure A-45 METSAT AMSU-A1 1356409-1 Receiver Assembly Point Elements

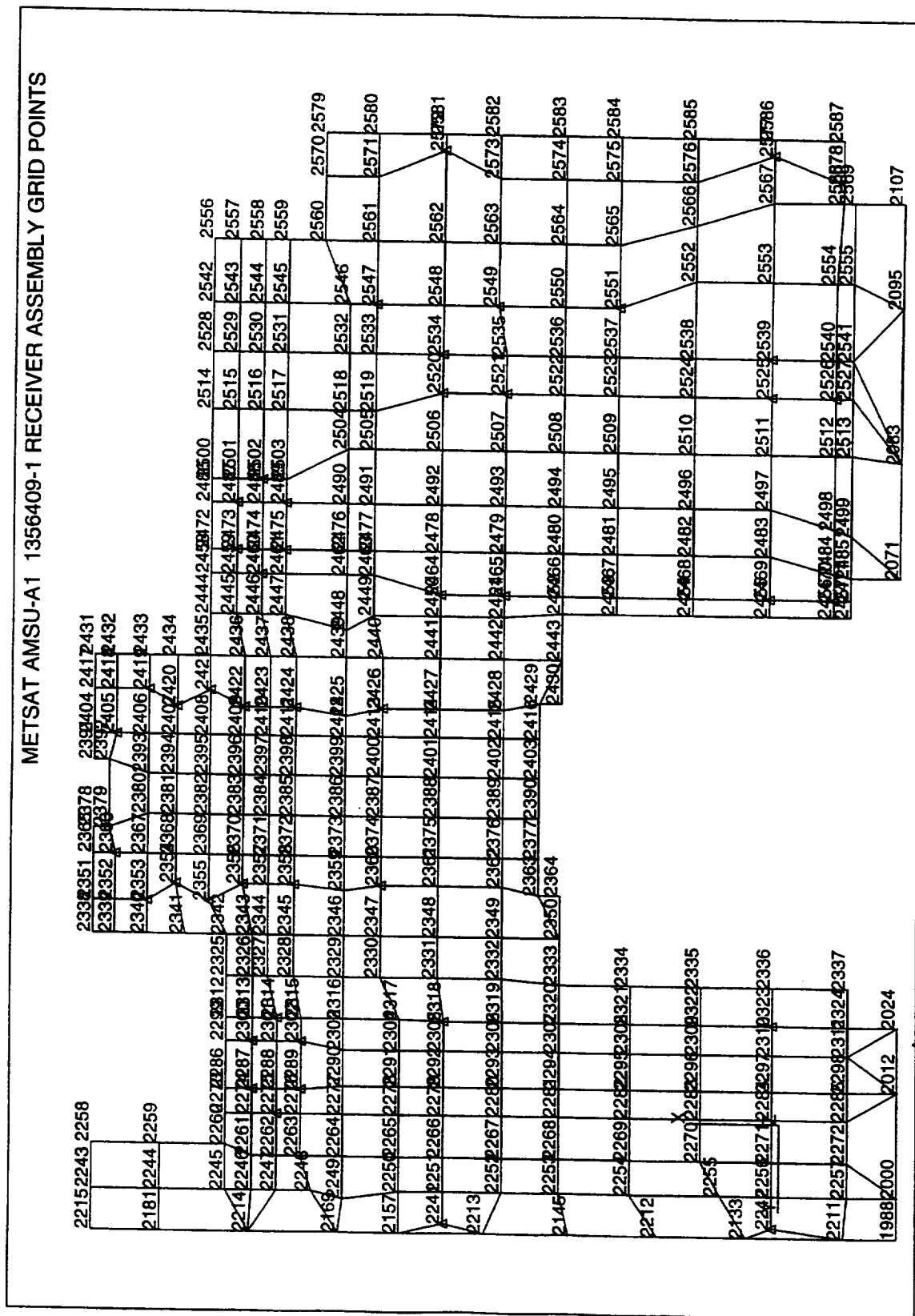


Figure A-46 METSAT AMSU-A1 1356409-1 Receiver Assembly Grid Points

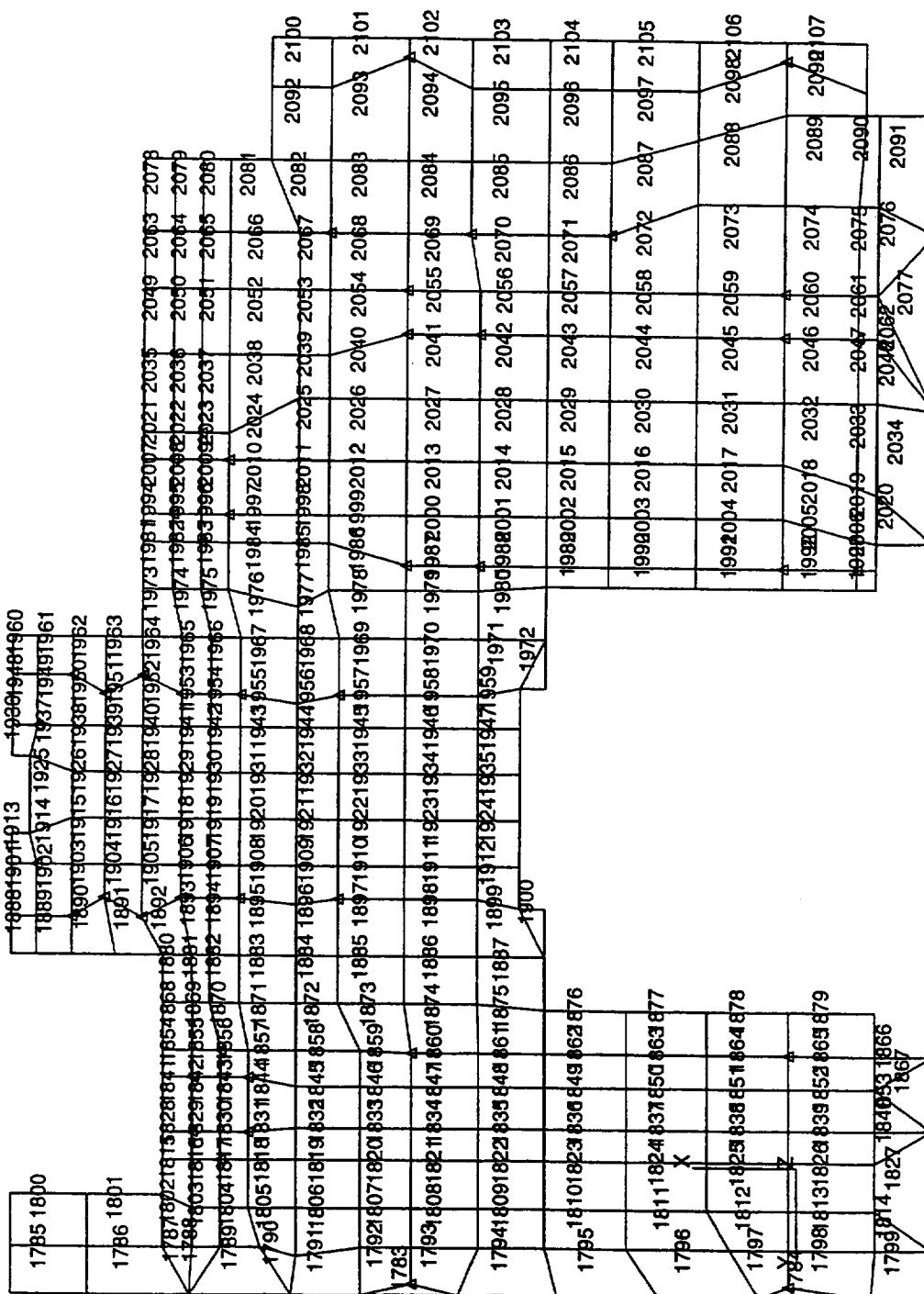


Figure A-47 METSAT AMSU-A1 1356409-1 Receiver Assembly Shell Elements

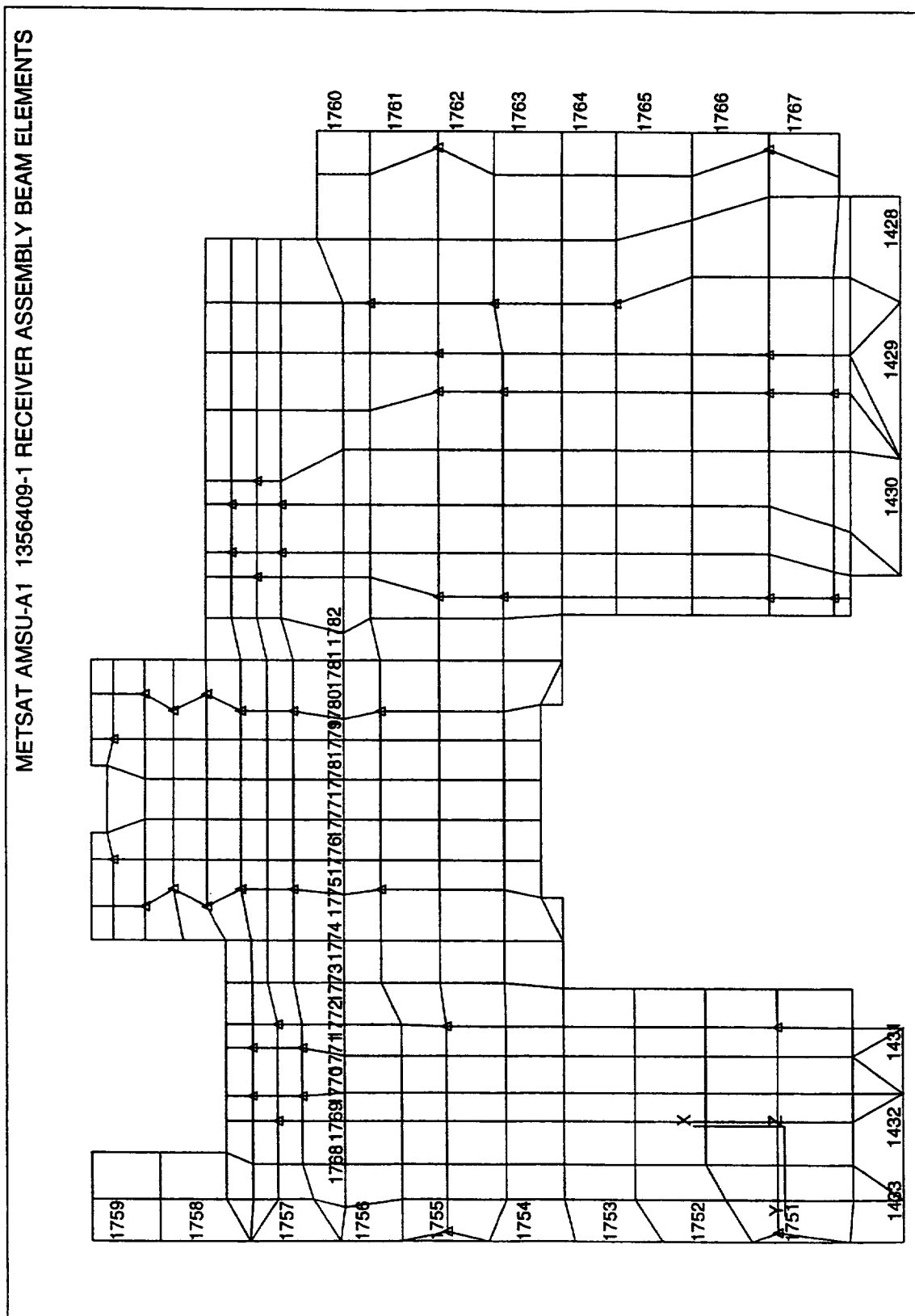


Figure A-48 METSAT AMSU-A1 1356409-1 Receiver Assembly Beam Elements

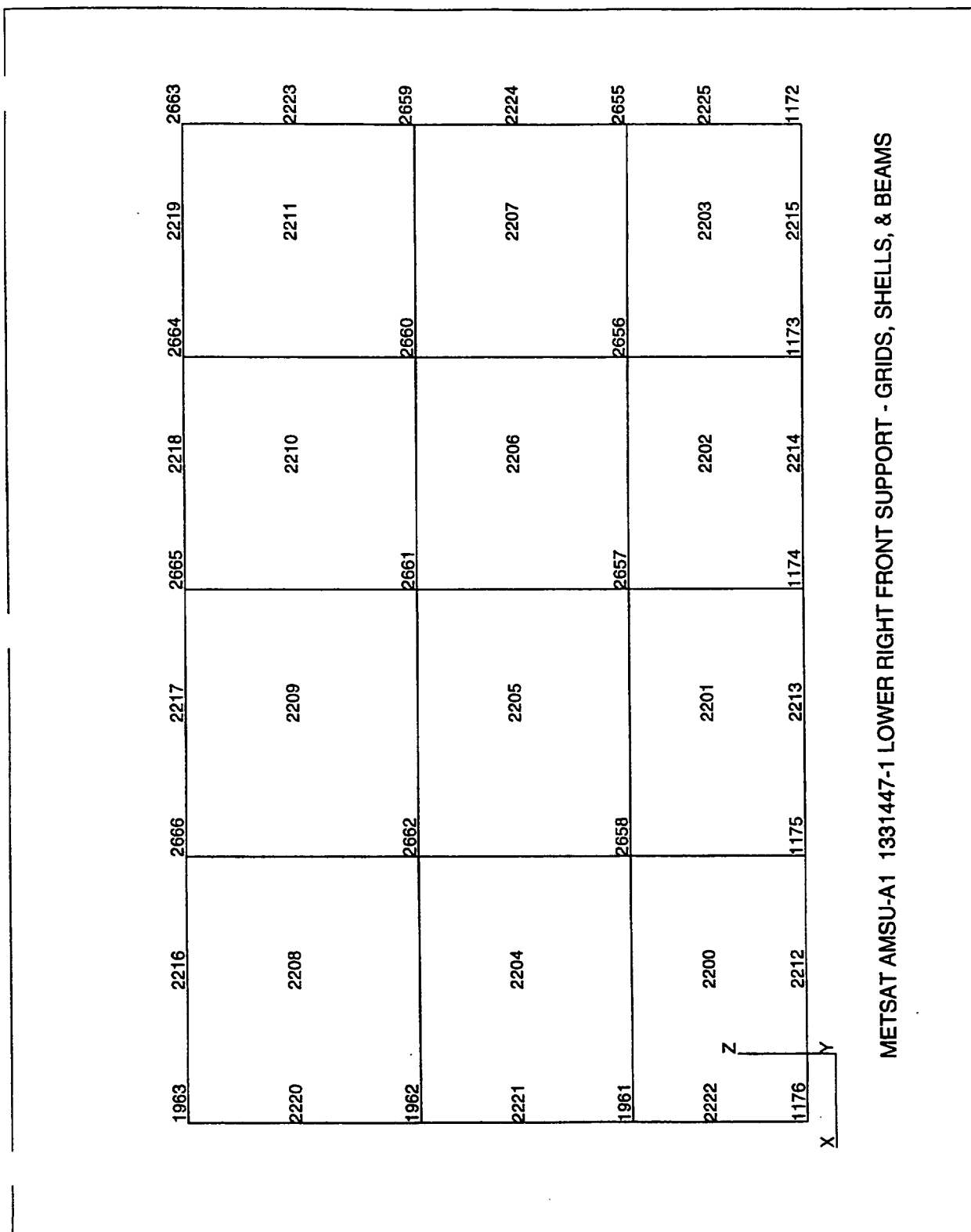


Figure A-49 METSAT AMSU-A1 1331447-1 Lower Right Front Support - Grids, Shells, & Beams

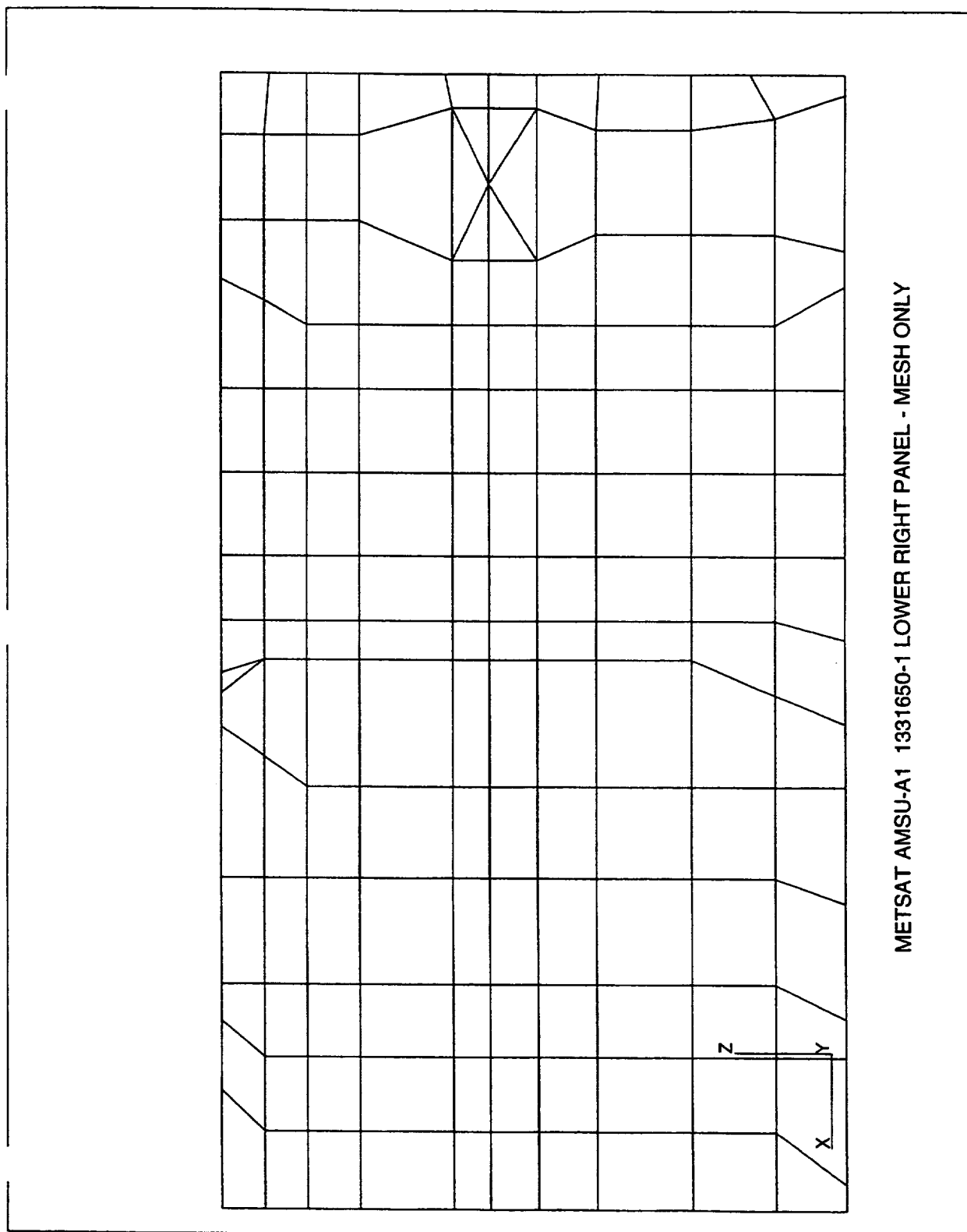
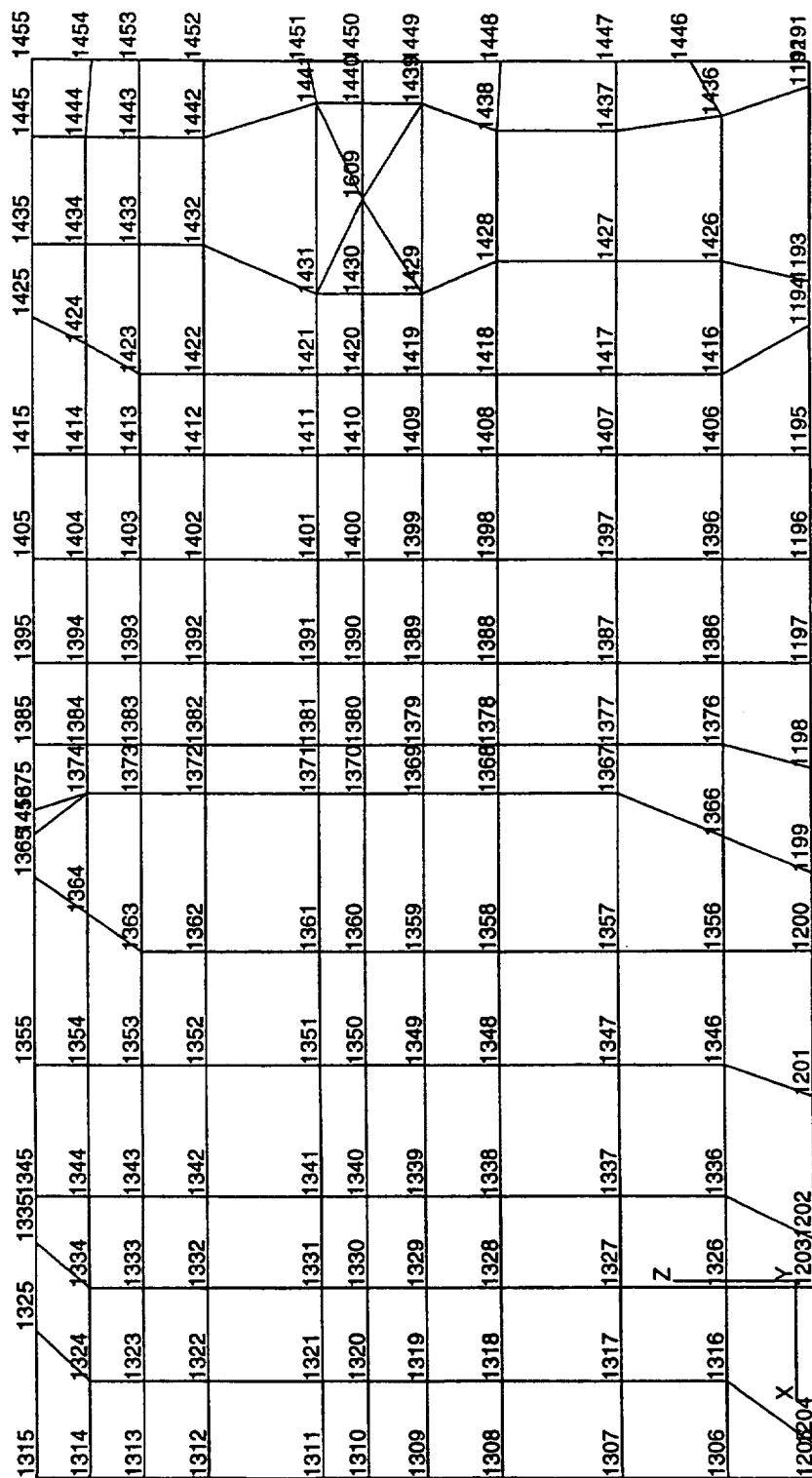


Figure A-50 METSAT AMSU-A1 1331650-1 Lower Right Panel Mesh only



METSAT AMSU-A1 1331650-1 LOWER RIGHT PANEL - GRIDS POINTS

Figure A-51 METSAT AMSU-A1 1331650-1 Lower Right Panel - Grid Points

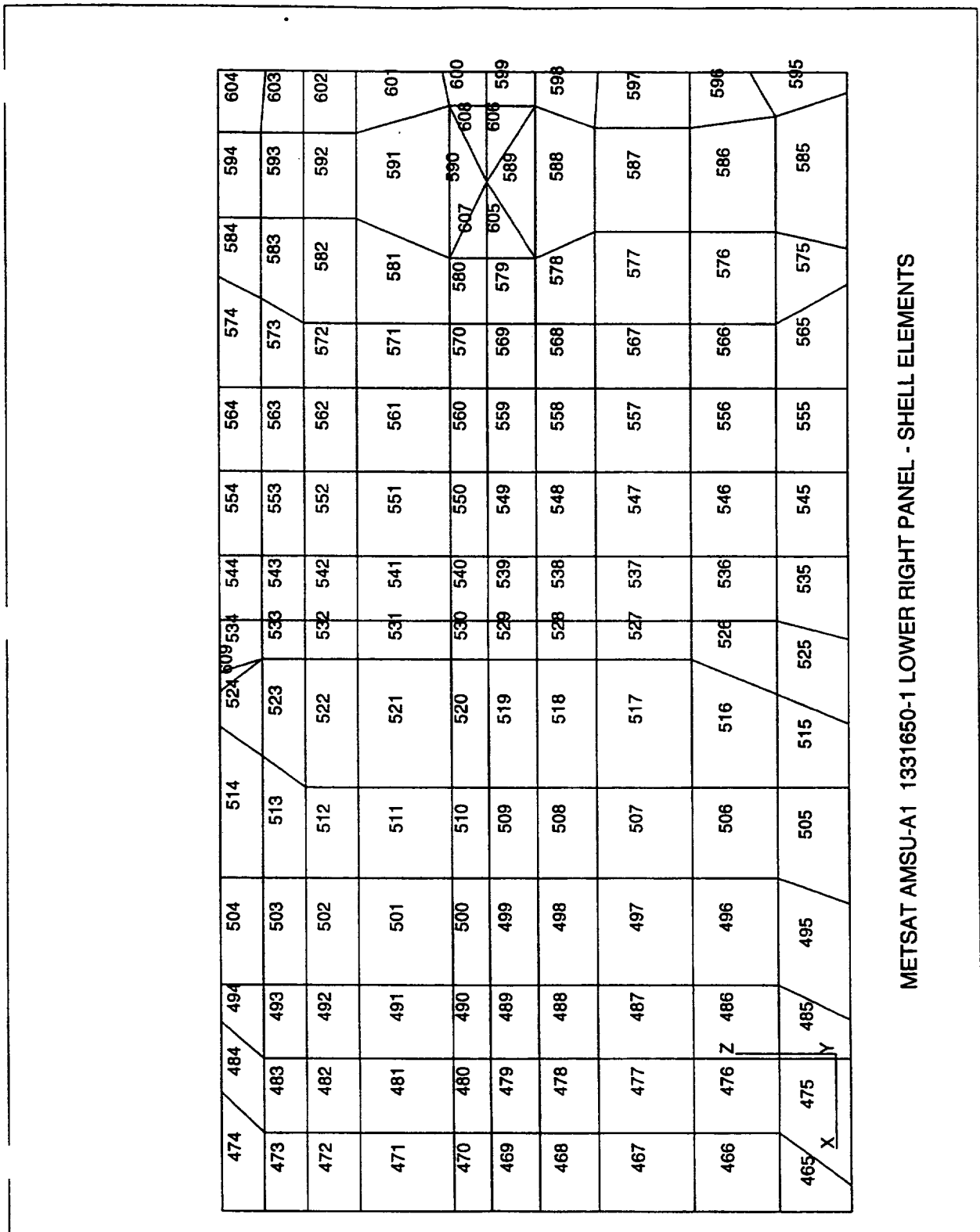
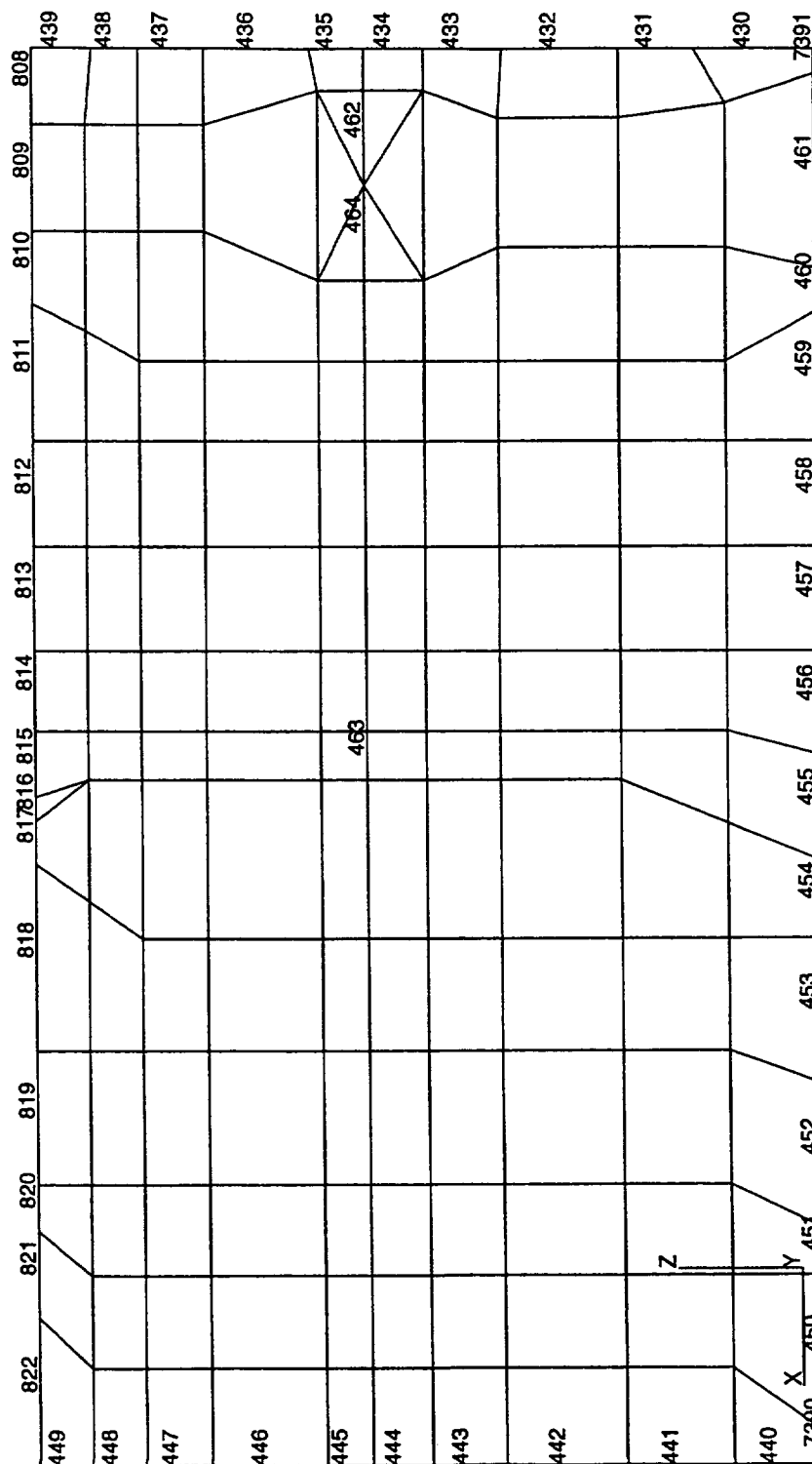


Figure A-52 METSAT AMSU-A1 1331650-1 Lower Right Panel - Shell Elements



METSAT AMSU-A1 1331650-1 LOWER RIGHT PANEL - BEAM ELEMENTS

Figure A-53 METSAT AMSU-A1 133650-1 Lower Right Panel - Beam Elements

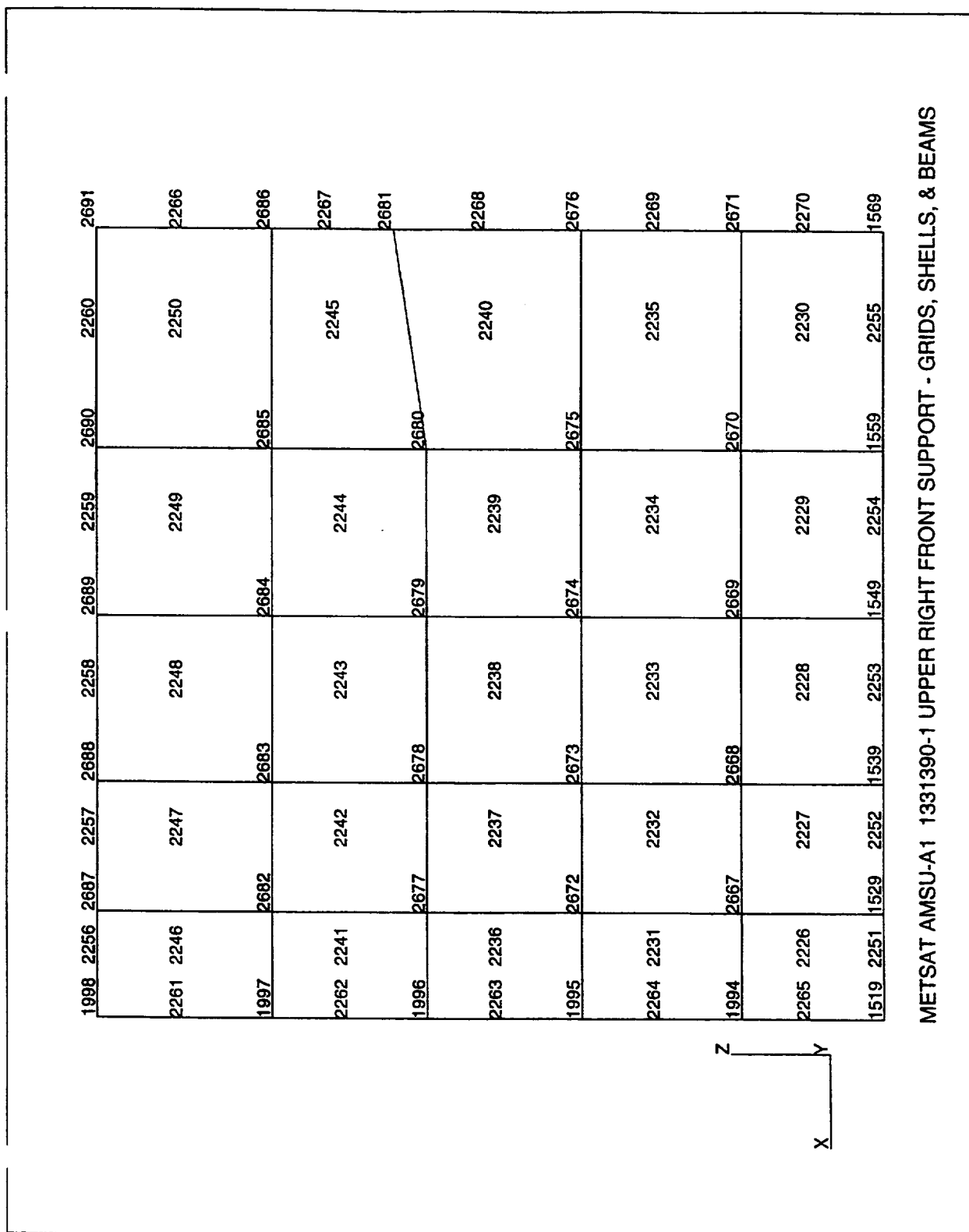


Figure A-54 METSAT AMSU-A1 1331390-1 Upper Right Front Support - Grids, Shells, & Beams

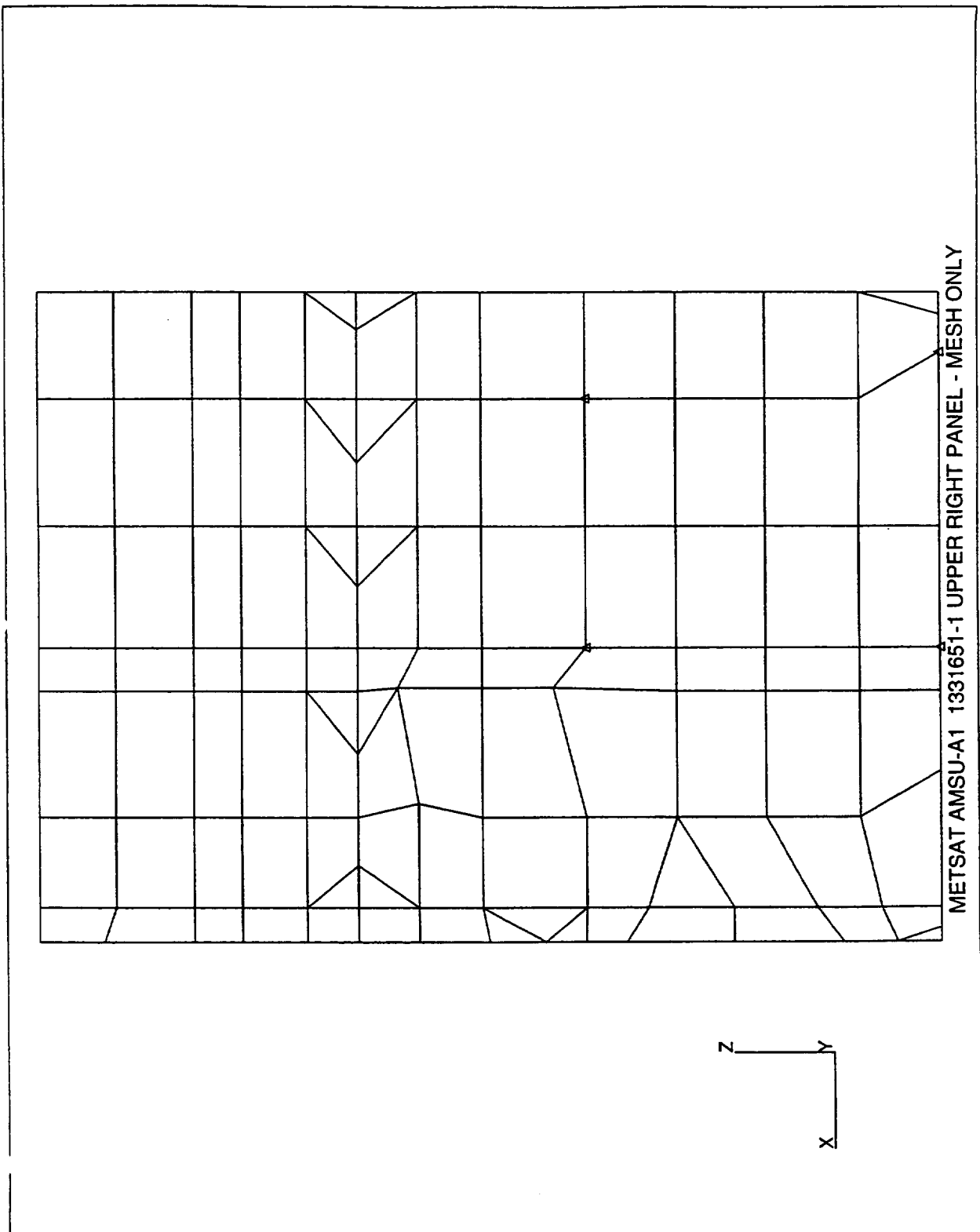


Figure A-55 METSAT AMSU-A1 1331651-1 Upper Right Panel Mesh Only

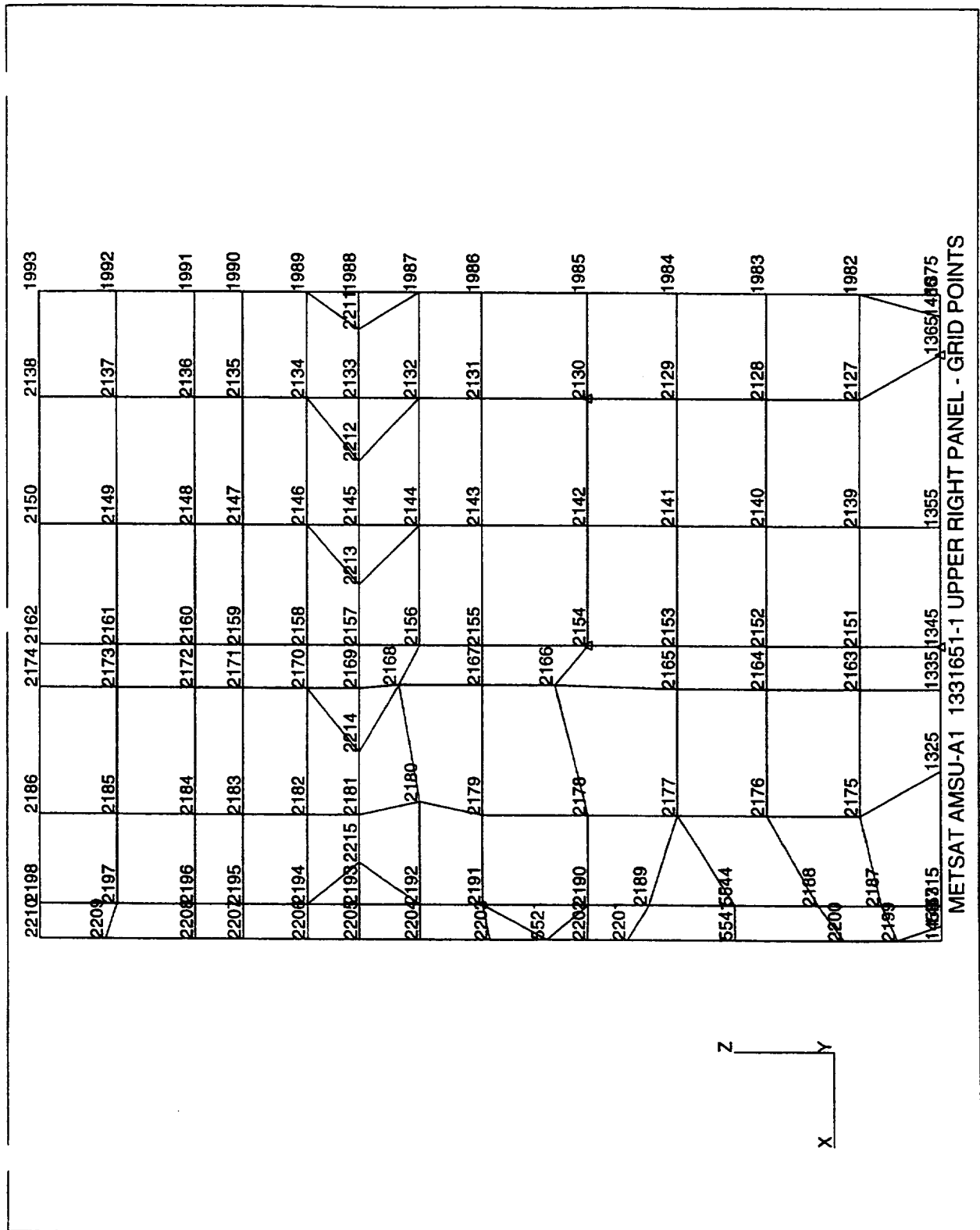


Figure A-56 METSAT AMSU-A1 1331651-1 Upper Right Panel Grid Points

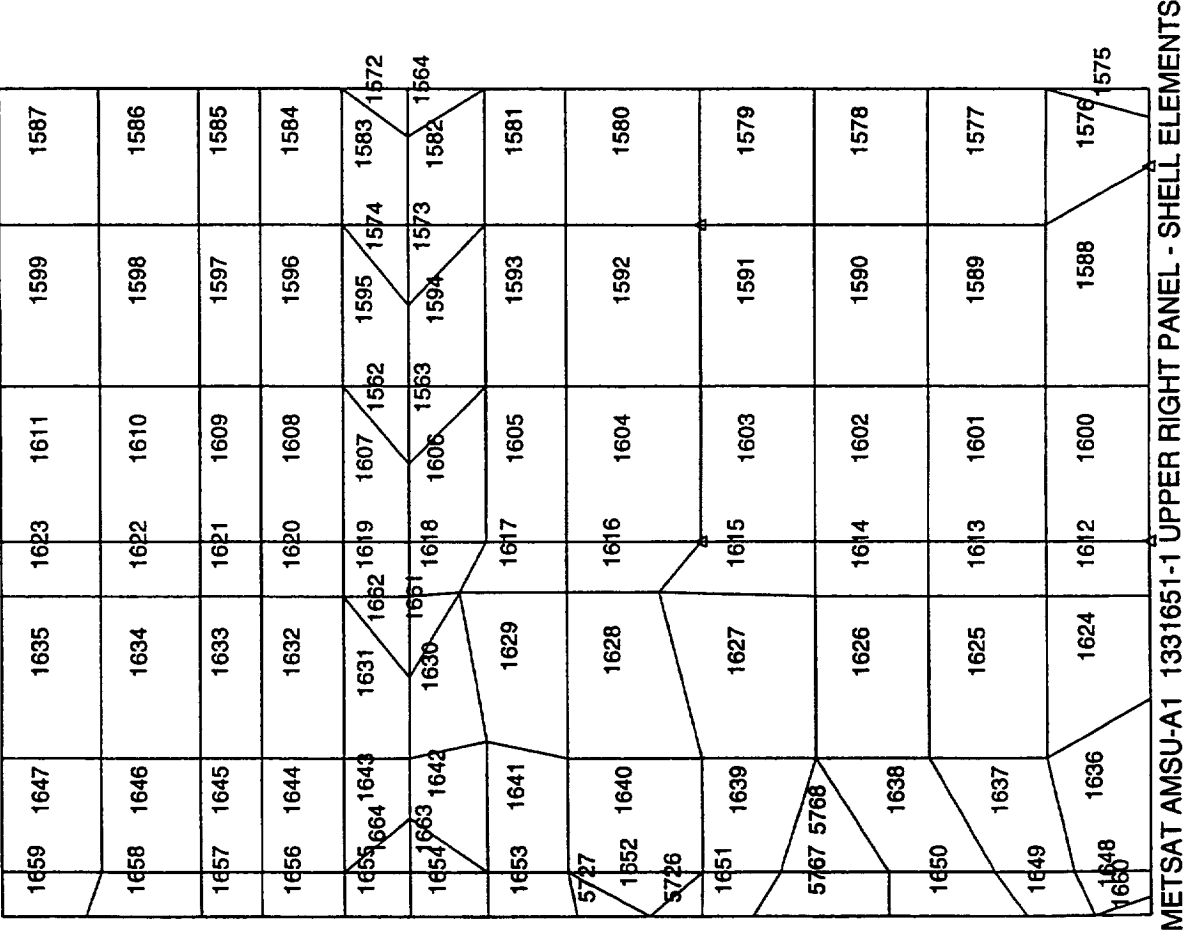


Figure A-57 METSAT AMSU-A1 1331651-1 Upper Right Panel Shell Elements

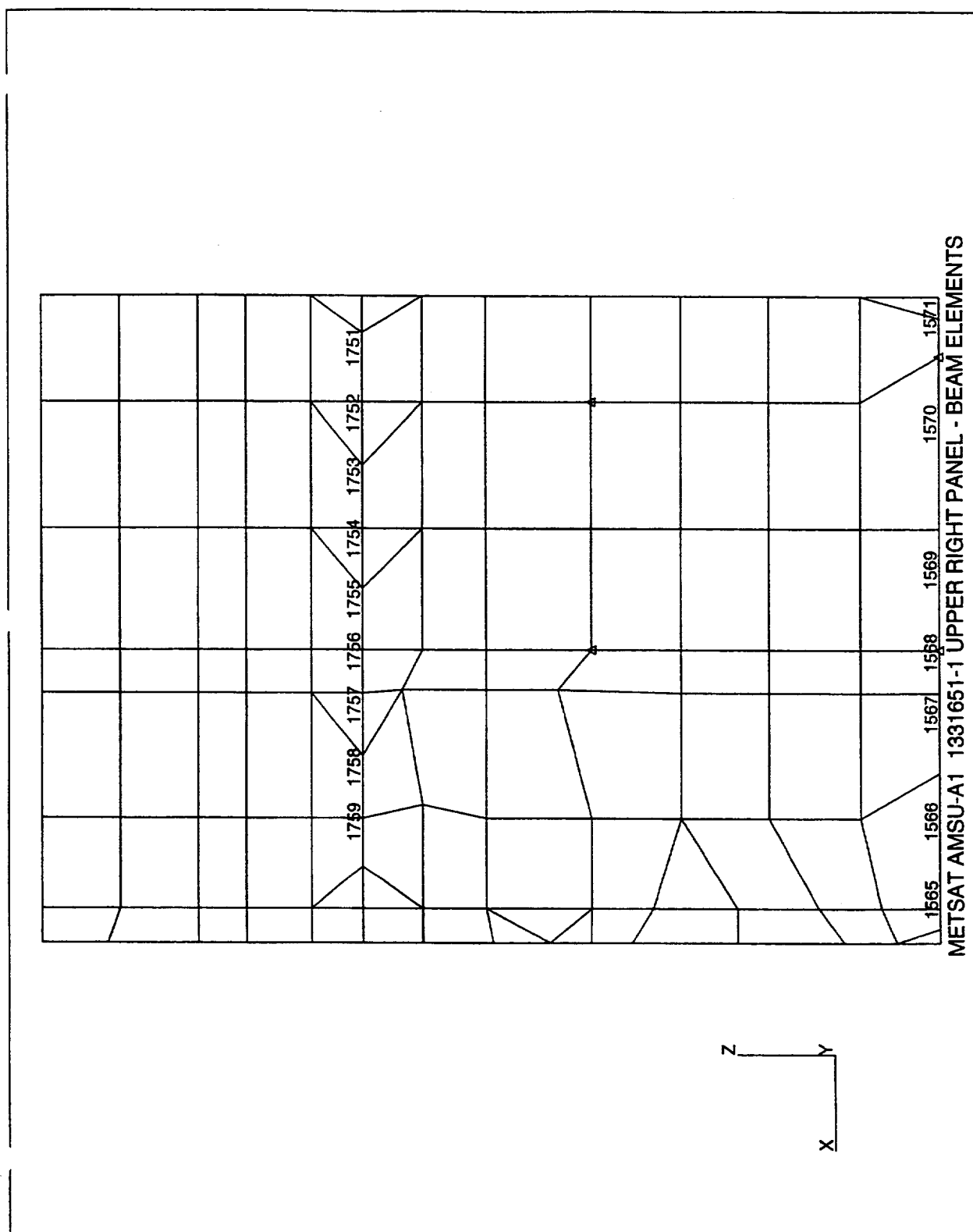


Figure A-58 METSAT AMSU-A1 1331651-1 Upper Right Panel Beam Elements

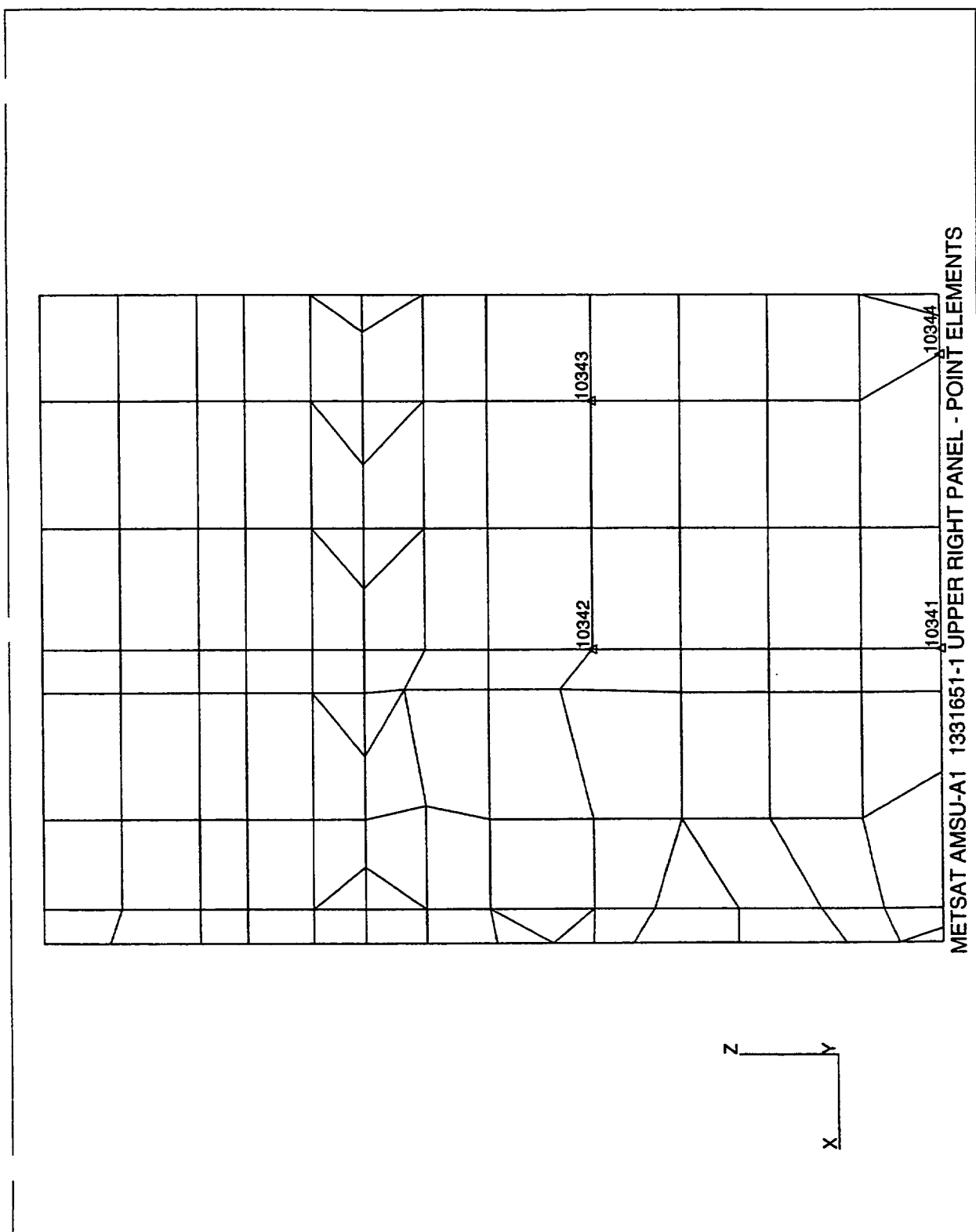


Figure A-59 METSAT AMSU-A1 1331651-1 Upper Right Panel Point Elements

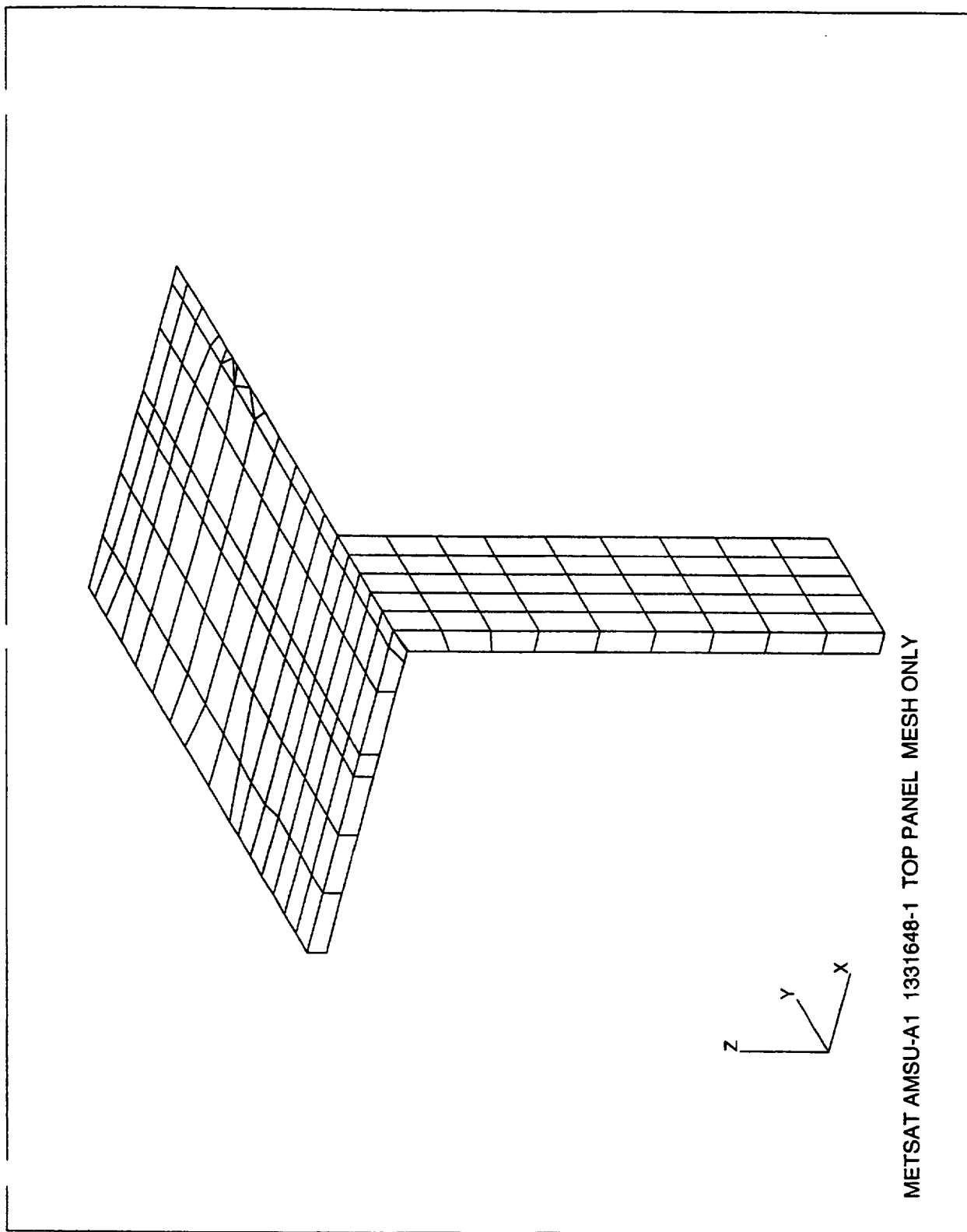
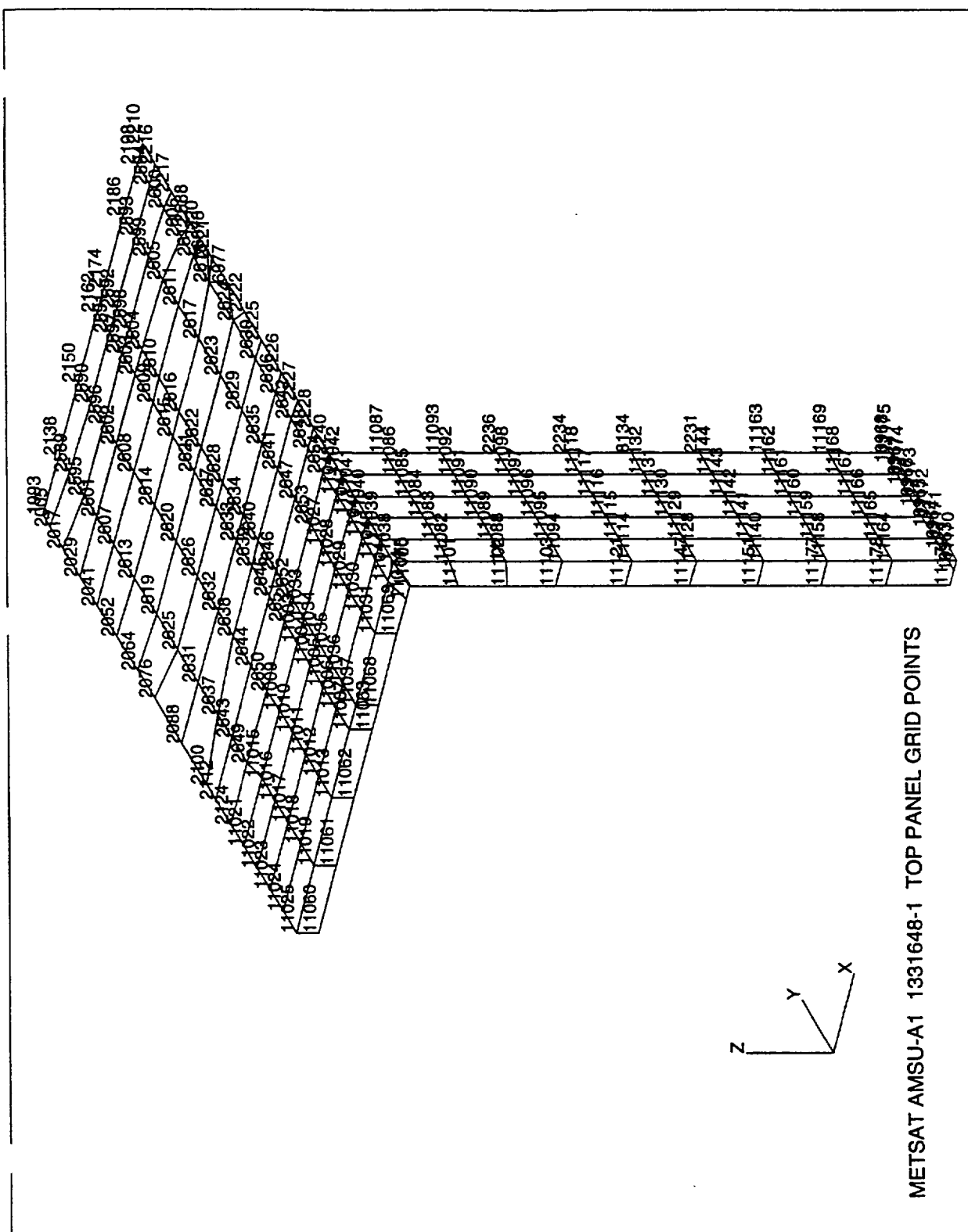


Figure A-60 METSAT AMSU-A1 1331648-1 Top Panel Mesh Only



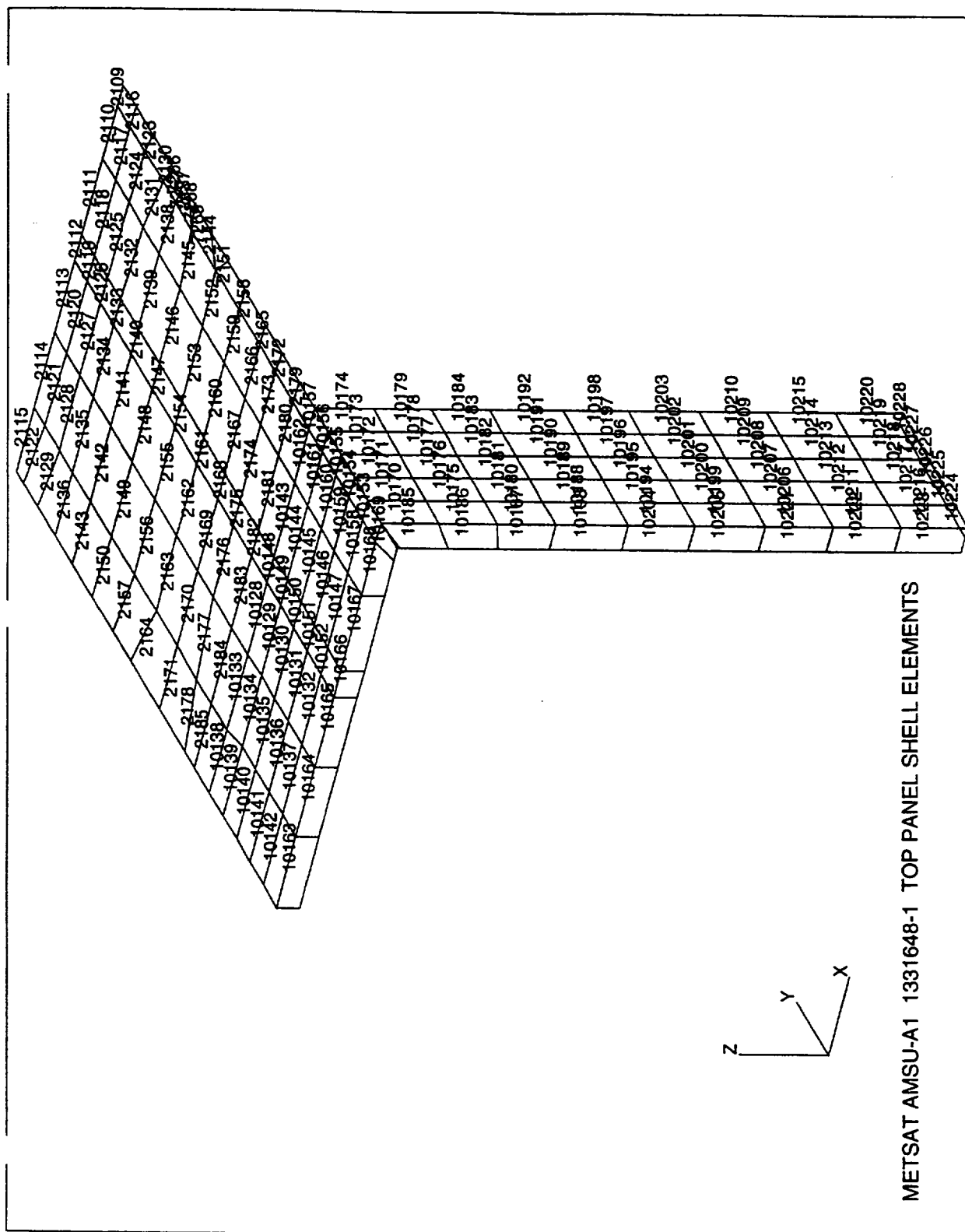
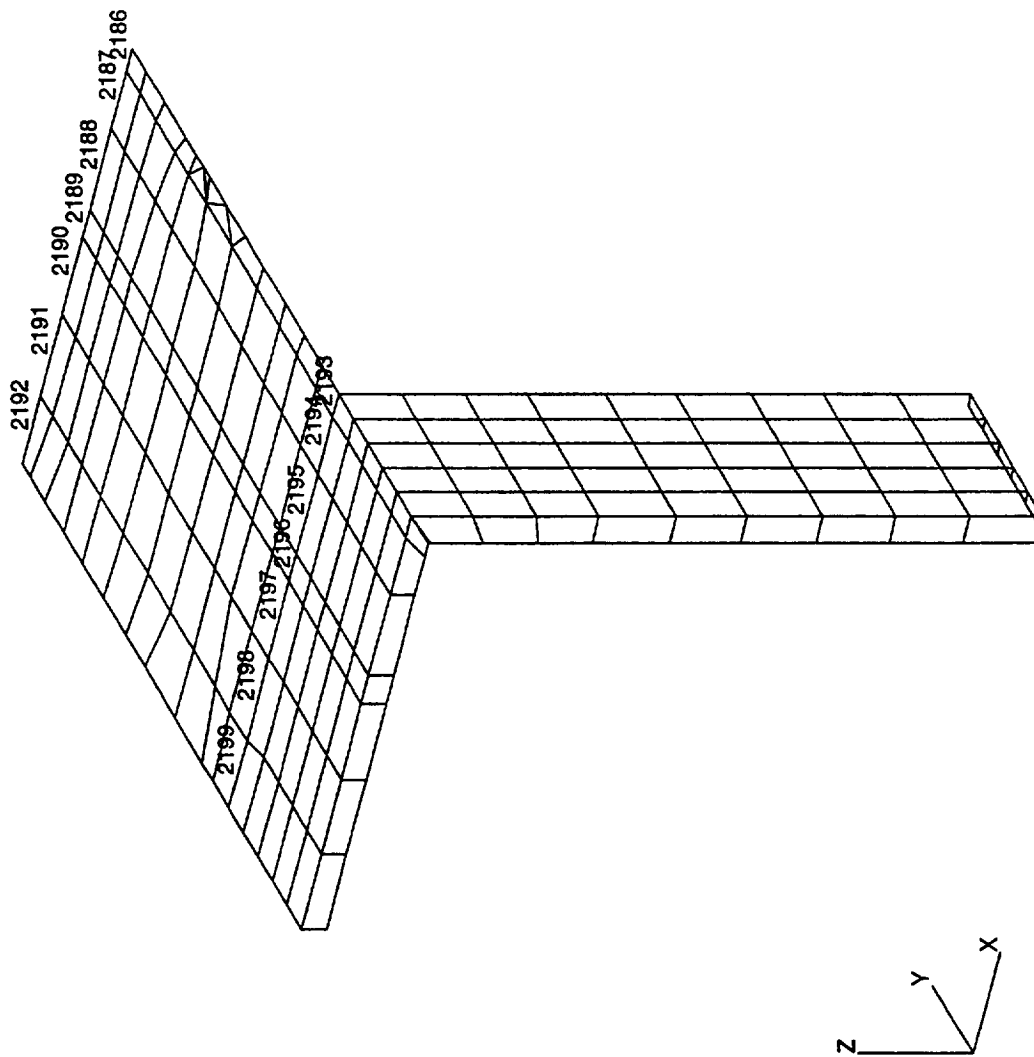


Figure A-62 METSAT AMSU-A1 1331648-1 Top Panel Shell Elements



METSAT AMSU-A1 1331648-1 TOP PANEL BEAM ELEMENTS

Figure A-63 METSAT AMSU-A1 1331648-1 Top Panel Beam Elements

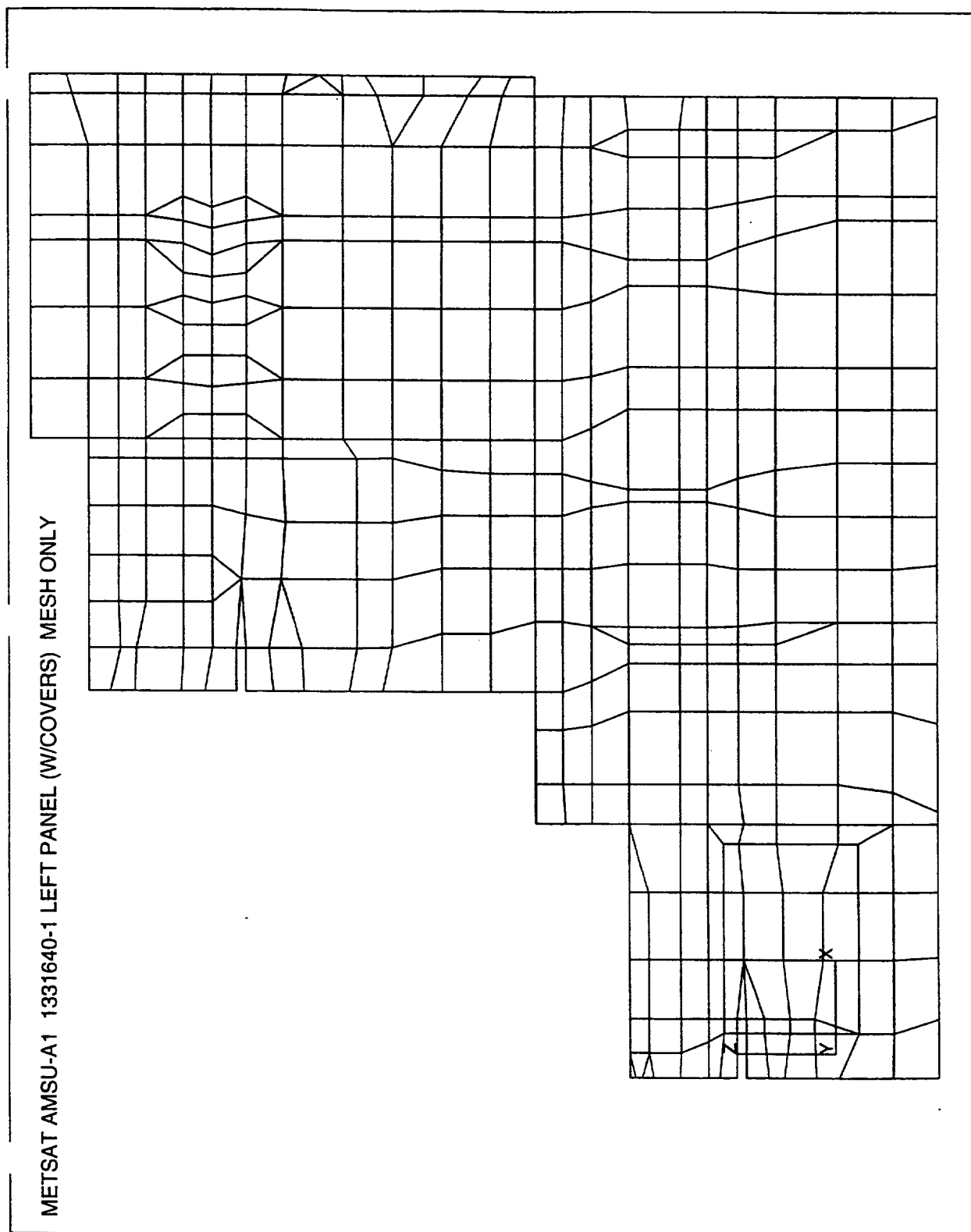


Figure A-64 METSAT AMSU-A1 1331640-1 Left Panel (W/Covers) Mesh Only

METSAT AMSU-A1 1331640-1 LEFT PANEL (W/COVERS) GRID POINTS

Figure A-65 METSAT AMSU-A1 1331640-1 Left Panel (W/Covers) Grid Points

METSAT AMSU-A1 1331640-1 LEFT PANEL (W/COVERS) SHELL ELEMENTS											
3129	3181	3132	3133	3134	3135	3136	3137	3138	3139	3140	3141
3142	3143	3144	3145	3146	3147	3148	3149	3150	3151	3152	3153
3154	3155	3156	3157	3158	3159	3160	3161	3162	3163	3164	3165
3166	3167	3168	3169	3170	3171	3172	3173	3174	3175	3176	3177
3178	3179	3180	3181	3182	3183	3184	3185	3186	3187	3188	3189
3190	3191	3192	3193	3194	3195	3196	3197	3198	3199	3200	3201
3202	3203	3204	3205	3206	3207	3208	3209	3210	3211	3212	3213
3214	3215	3216	3217	3218	3219	3220	3221	3222	3223	3224	3225
3226	3227	3228	3229	3230	3231	3232	3233	3234	3235	3236	3237
3238	3239	3240	3241	3242	3243	3244	3245	3246	3247	3248	3249
3250	3251	3252	3253	3254	3255	3256	3257	3258	3259	3260	3261
3262	3263	3264	3265	3266	3267	3268	3269	3270	3271	3272	3273
3274	3275	3276	3277	3278	3279	3280	3281	3282	3283	3284	3285
3286	3287	3288	3289	3290	3291	3292	3293	3294	3295	3296	3297
3298	3299	3300	3301	3302	3303	3304	3305	3306	3307	3308	3309
3310	3311	3312	3313	3314	3315	3316	3317	3318	3319	3320	3321
3322	3323	3324	3325	3326	3327	3328	3329	3330	3331	3332	3333
3334	3335	3336	3337	3338	3339	3340	3341	3342	3343	3344	3345
3346	3347	3348	3349	3350	3351	3352	3353	3354	3355	3356	3357
3358	3359	3360	3361	3362	3363	3364	3365	3366	3367	3368	3369
3370	3371	3372	3373	3374	3375	3376	3377	3378	3379	3380	3381
3382	3383	3384	3385	3386	3387	3388	3389	3390	3391	3392	3393
3394	3395	3396	3397	3398	3399	3400	3401	3402	3403	3404	3405
3406	3407	3408	3409	3410	3411	3412	3413	3414	3415	3416	3417
3418	3419	3420	3421	3422	3423	3424	3425	3426	3427	3428	3429
3430	3431	3432	3433	3434	3435	3436	3437	3438	3439	3440	3441
3442	3443	3444	3445	3446	3447	3448	3449	3450	3451	3452	3453
3454	3455	3456	3457	3458	3459	3460	3461	3462	3463	3464	3465
3466	3467	3468	3469	3470	3471	3472	3473	3474	3475	3476	3477
3478	3479	3480	3481	3482	3483	3484	3485	3486	3487	3488	3489
3490	3491	3492	3493	3494	3495	3496	3497	3498	3499	3500	3501
3502	3503	3504	3505	3506	3507	3508	3509	3510	3511	3512	3513
3514	3515	3516	3517	3518	3519	3520	3521	3522	3523	3524	3525
3526	3527	3528	3529	3530	3531	3532	3533	3534	3535	3536	3537
3538	3539	3540	3541	3542	3543	3544	3545	3546	3547	3548	3549
3550	3551	3552	3553	3554	3555	3556	3557	3558	3559	3560	3561
3562	3563	3564	3565	3566	3567	3568	3569	3570	3571	3572	3573
3574	3575	3576	3577	3578	3579	3580	3581	3582	3583	3584	3585
3586	3587	3588	3589	3590	3591	3592	3593	3594	3595	3596	3597
3598	3599	3600	3601	3602	3603	3604	3605	3606	3607	3608	3609
3610	3611	3612	3613	3614	3615	3616	3617	3618	3619	3620	3621
3622	3623	3624	3625	3626	3627	3628	3629	3630	3631	3632	3633
3634	3635	3636	3637	3638	3639	3640	3641	3642	3643	3644	3645
3646	3647	3648	3649	3650	3651	3652	3653	3654	3655	3656	3657
3658	3659	3660	3661	3662	3663	3664	3665	3666	3667	3668	3669
3670	3671	3672	3673	3674	3675	3676	3677	3678	3679	3680	3681
3682	3683	3684	3685	3686	3687	3688	3689	3690	3691	3692	3693
3694	3695	3696	3697	3698	3699	3700	3701	3702	3703	3704	3705
3706	3707	3708	3709	3710	3711	3712	3713	3714	3715	3716	3717
3718	3719	3720	3721	3722	3723	3724	3725	3726	3727	3728	3729
3730	3731	3732	3733	3734	3735	3736	3737	3738	3739	3740	3741
3742	3743	3744	3745	3746	3747	3748	3749	3750	3751	3752	3753
3754	3755	3756	3757	3758	3759	3760	3761	3762	3763	3764	3765
3766	3767	3768	3769	3770	3771	3772	3773	3774	3775	3776	3777
3778	3779	3780	3781	3782	3783	3784	3785	3786	3787	3788	3789
3790	3791	3792	3793	3794	3795	3796	3797	3798	3799	3800	3801
3802	3803	3804	3805	3806	3807	3808	3809	3810	3811	3812	3813
3814	3815	3816	3817	3818	3819	3820	3821	3822	3823	3824	3825
3826	3827	3828	3829	3830	3831	3832	3833	3834	3835	3836	3837
3838	3839	3840	3841	3842	3843	3844	3845	3846	3847	3848	3849
3850	3851	3852	3853	3854	3855	3856	3857	3858	3859	3860	3861
3862	3863	3864	3865	3866	3867	3868	3869	3870	3871	3872	3873
3874	3875	3876	3877	3878	3879	3880	3881	3882	3883	3884	3885
3886	3887	3888	3889	3890	3891	3892	3893	3894	3895	3896	3897
3898	3899	3900	3901	3902	3903	3904	3905	3906	3907	3908	3909
3910	3911	3912	3913	3914	3915	3916	3917	3918	3919	3920	3921
3922	3923	3924	3925	3926	3927	3928	3929	3930	3931	3932	3933
3934	3935	3936	3937	3938	3939	3940	3941	3942	3943	3944	3945
3946	3947	3948	3949	3950	3951	3952	3953	3954	3955	3956	3957
3958	3959	3960	3961	3962	3963	3964	3965	3966	3967	3968	3969
3970	3971	3972	3973	3974	3975	3976	3977	3978	3979	3980	3981
3982	3983	3984	3985	3986	3987	3988	3989	3990	3991	3992	3993
3994	3995	3996	3997	3998	3999	4000	4001	4002	4003	4004	4005

Figure A-66 METSAT AMSU-A1 1331640-1 Left Panel (W/Covers) Shell Elements

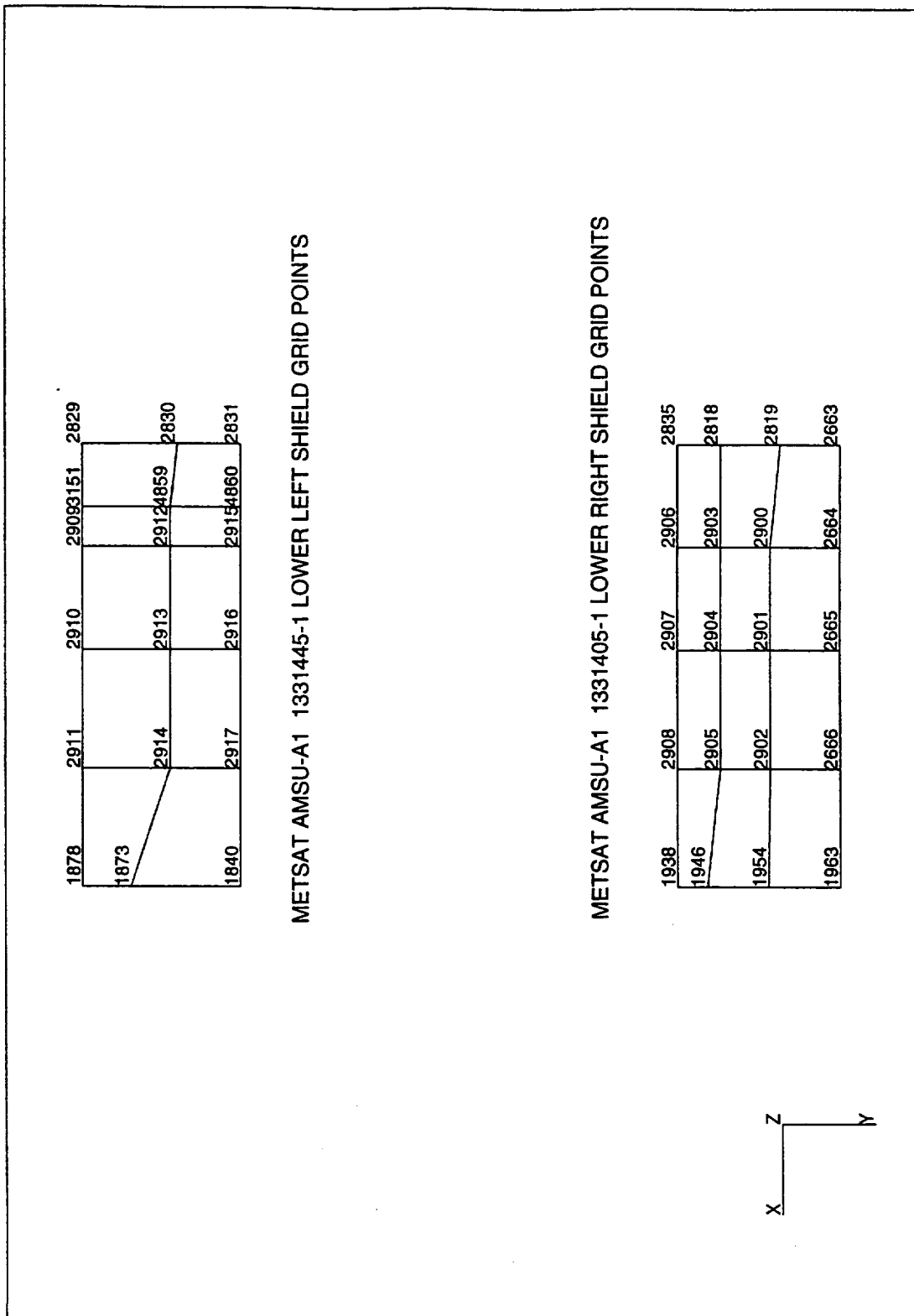


Figure A-67 METSAT AMSU-A1 1331445-1 Lower Left Shield Grid Points

Figure A-68 METSAT AMSU-A1 1331405-1 Lower Right Shield Grid Points

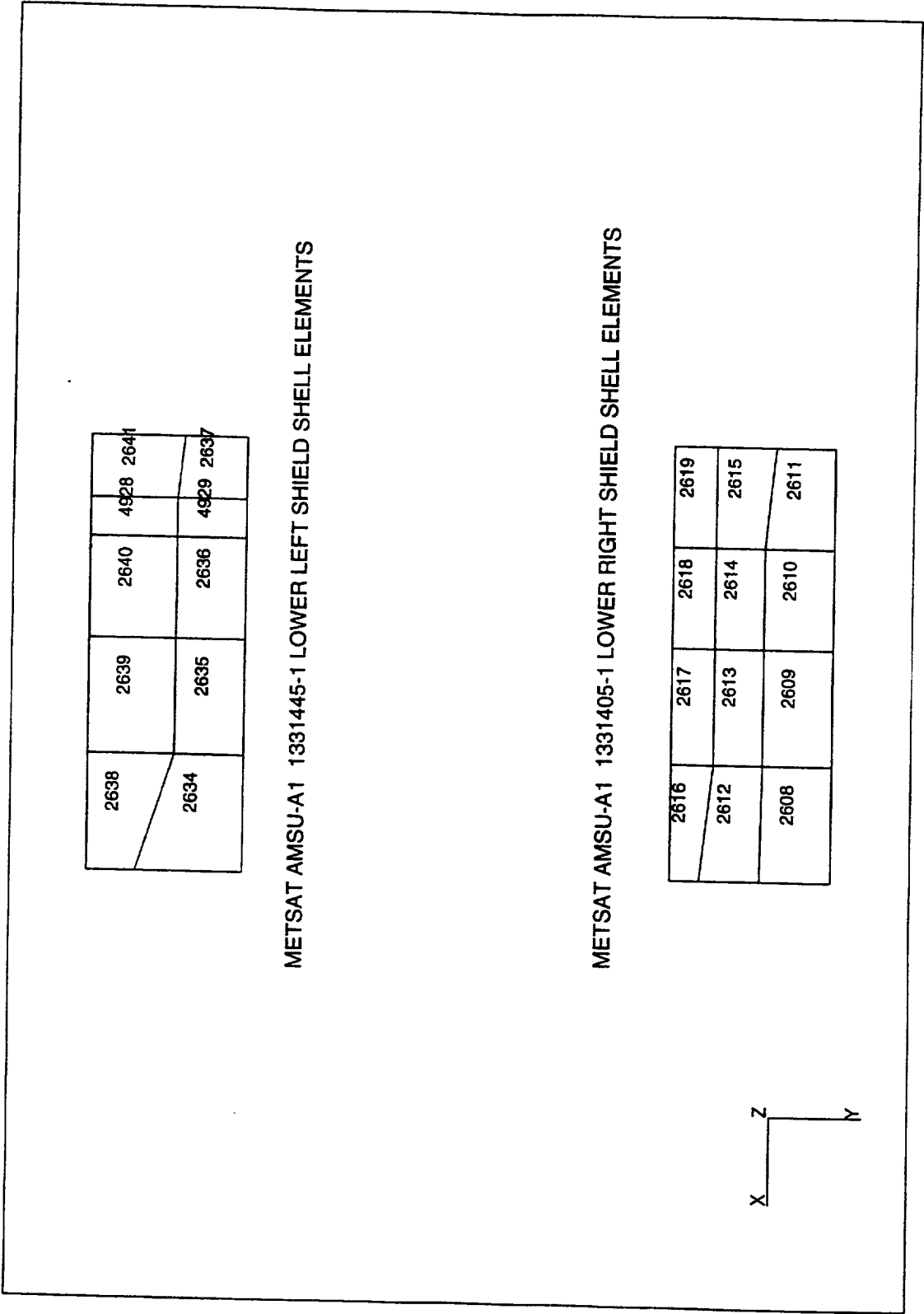


Figure A-69 METSAT AMSU-A1 1331445-1 Lower Left Shield Shell Elements

Figure A-70 METSAT AMSU-A1 1331405-1 Lower Right Shield Shell Elements

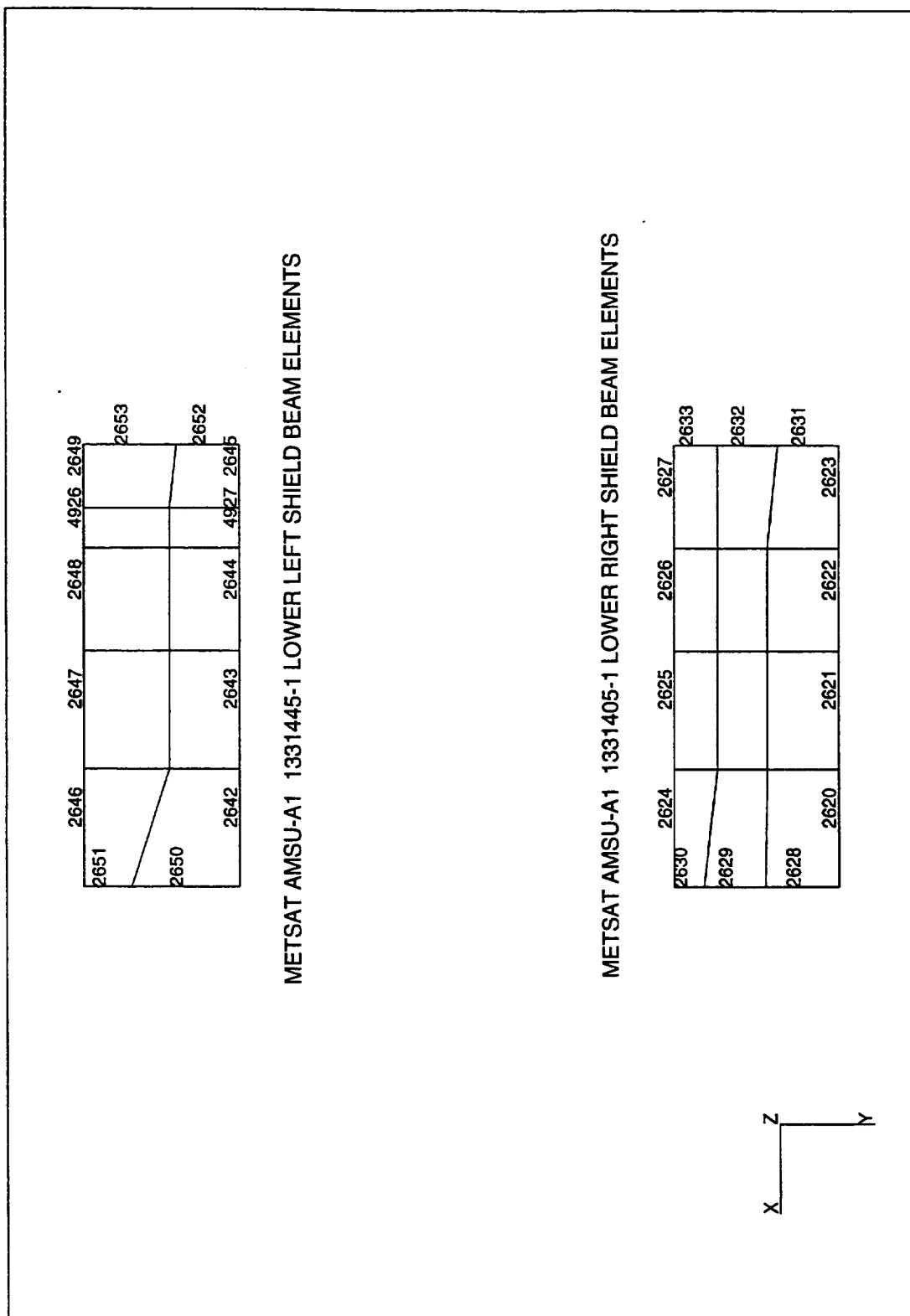


Figure A-71 METSAT AMSU-A1 1331445-1 Lower Left Shield Beam Elements

Figure A-72 METSAT AMSU-A1 1331405-1 Lower Right Shield Beam Elements

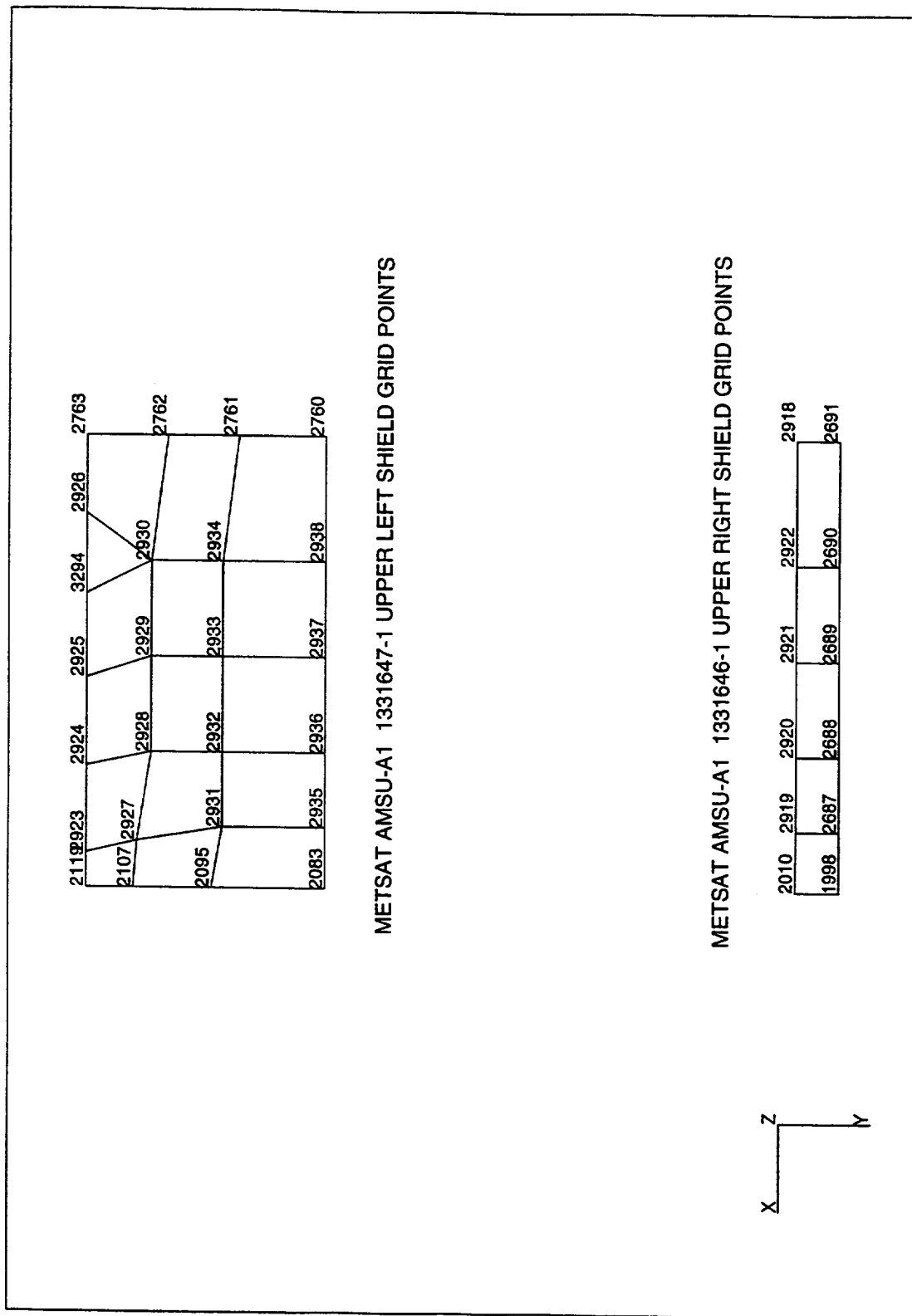


Figure A-73 METSAT AMSU-A1 1331647-1 Upper Left Shield Grid Points

Figure A-74 METSAT AMSU-A1 1331646-1 Upper Right Shield Grid Points

2682	2683	2684	2685	4924	2686
2677	2678	2679	2680	2681	
2672	2673	2674	2675	2676	

METSAT AMSU-A1 1331647-1 UPPER LEFT SHIELD SHELL ELEMENTS

METSAT AMSU-A1 1331646-1 UPPER RIGHT SHIELD SHELL ELEMENTS

2655	2656	2657	2658	2659
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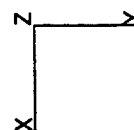


Figure A-75 METSAT AMSU-A1 1331647-1 Upper Left Shield Shell Elements

Figure A-76 METSAT AMSU-A1 1331646-1 Upper Right Shield Shell Elements

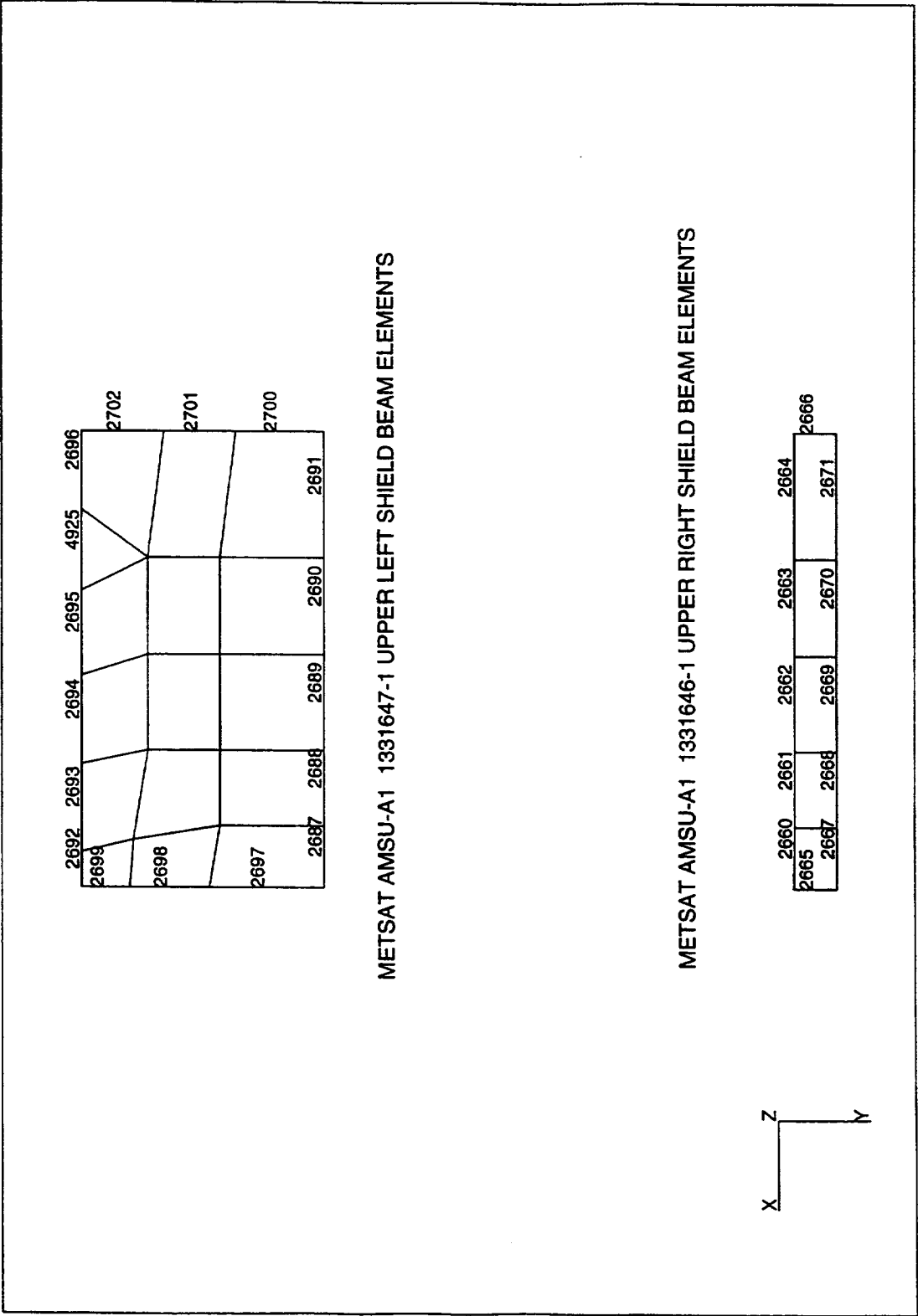


Figure A-77 METSAT AMSU-A1 1331647-1 Upper Left Shield Beam Elements

Figure A-78 METSAT AMSU-A1 1331646-1 Upper Right Shield Beam Elements

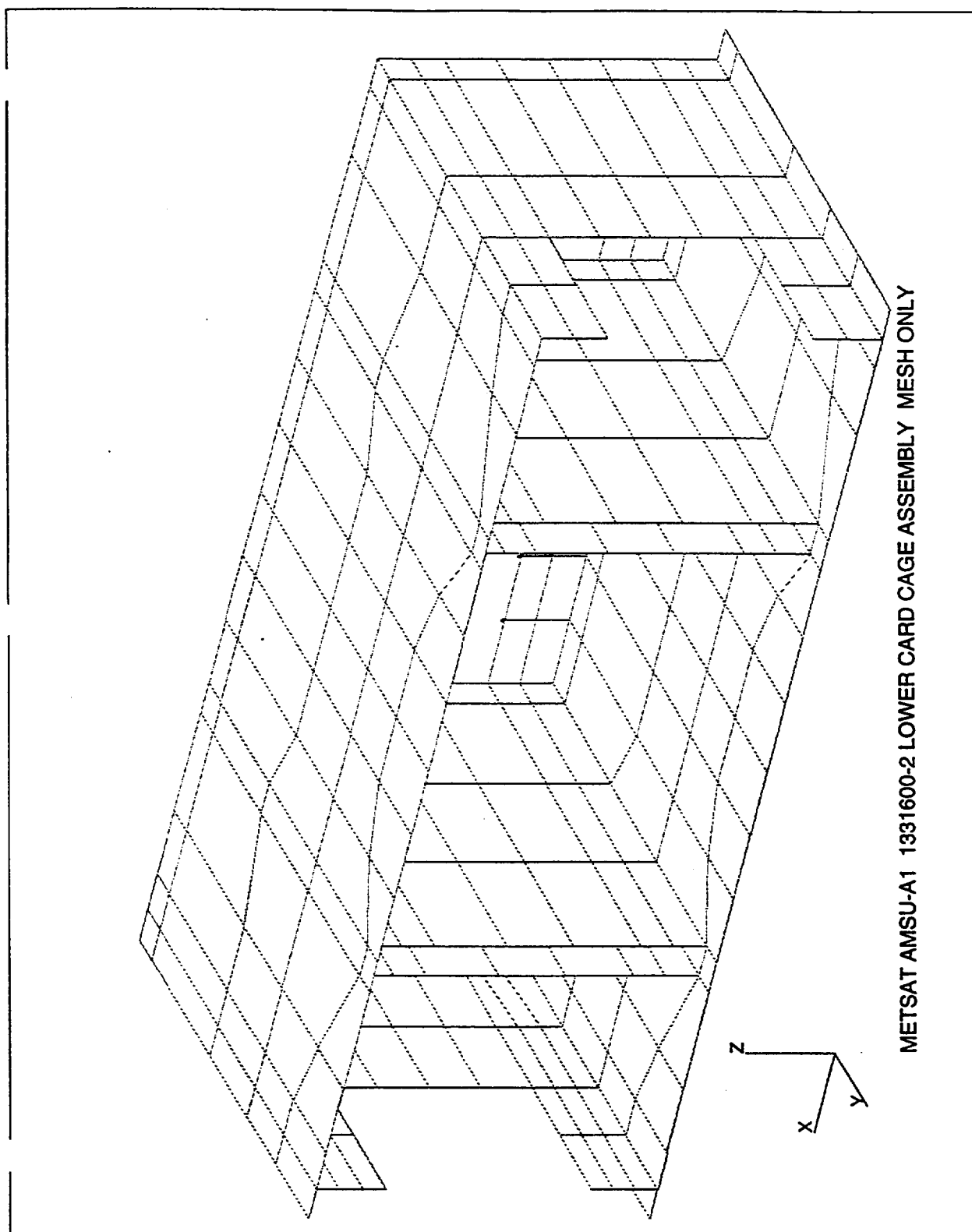


Figure A-79 METSAT AMSU-A1 1331600-2 Lower Card Cage Assembly Mesh Only

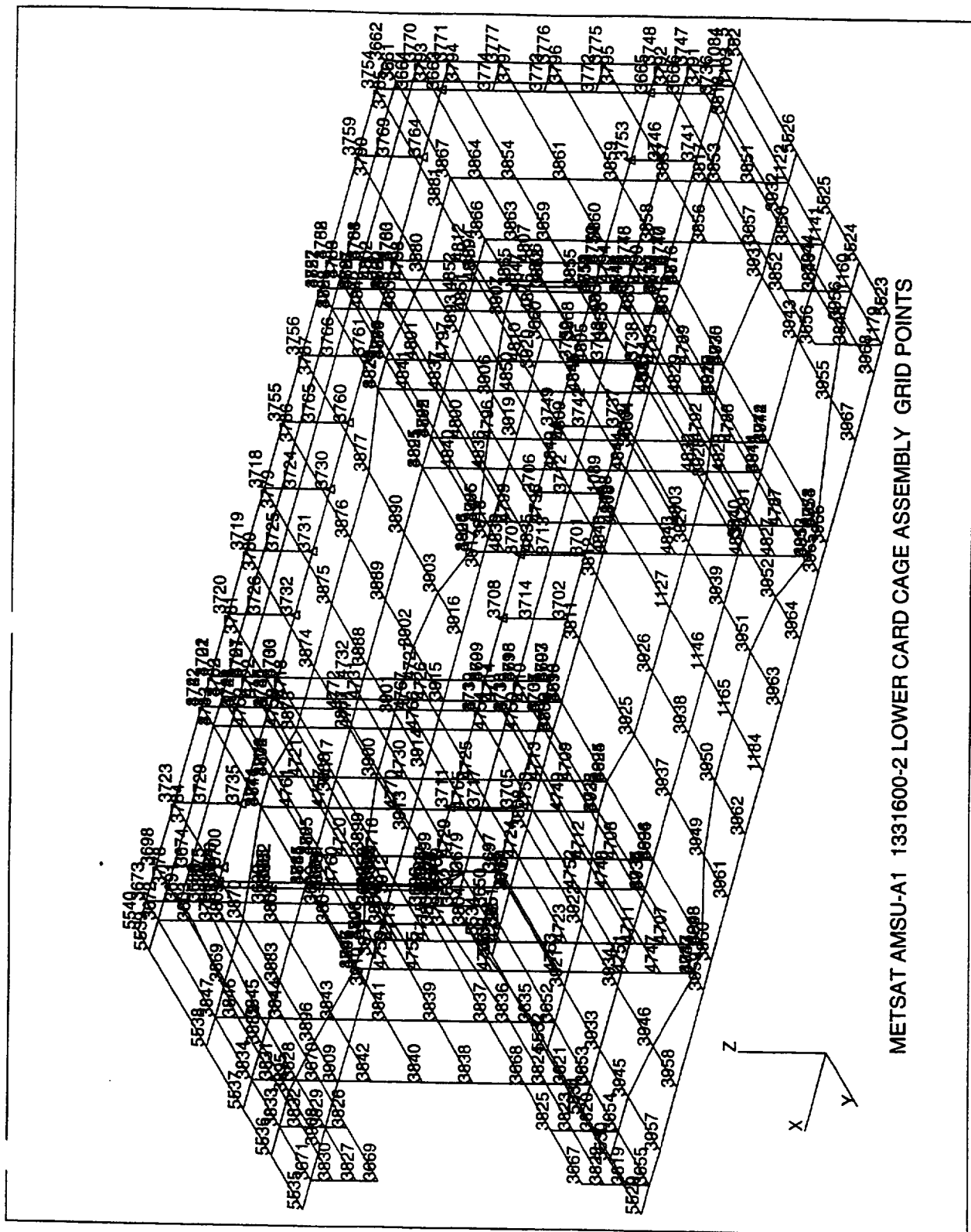


Figure A-80 METSAT AMSU-A1 1331600-2 Lower Card Cage Assembly Grid Points

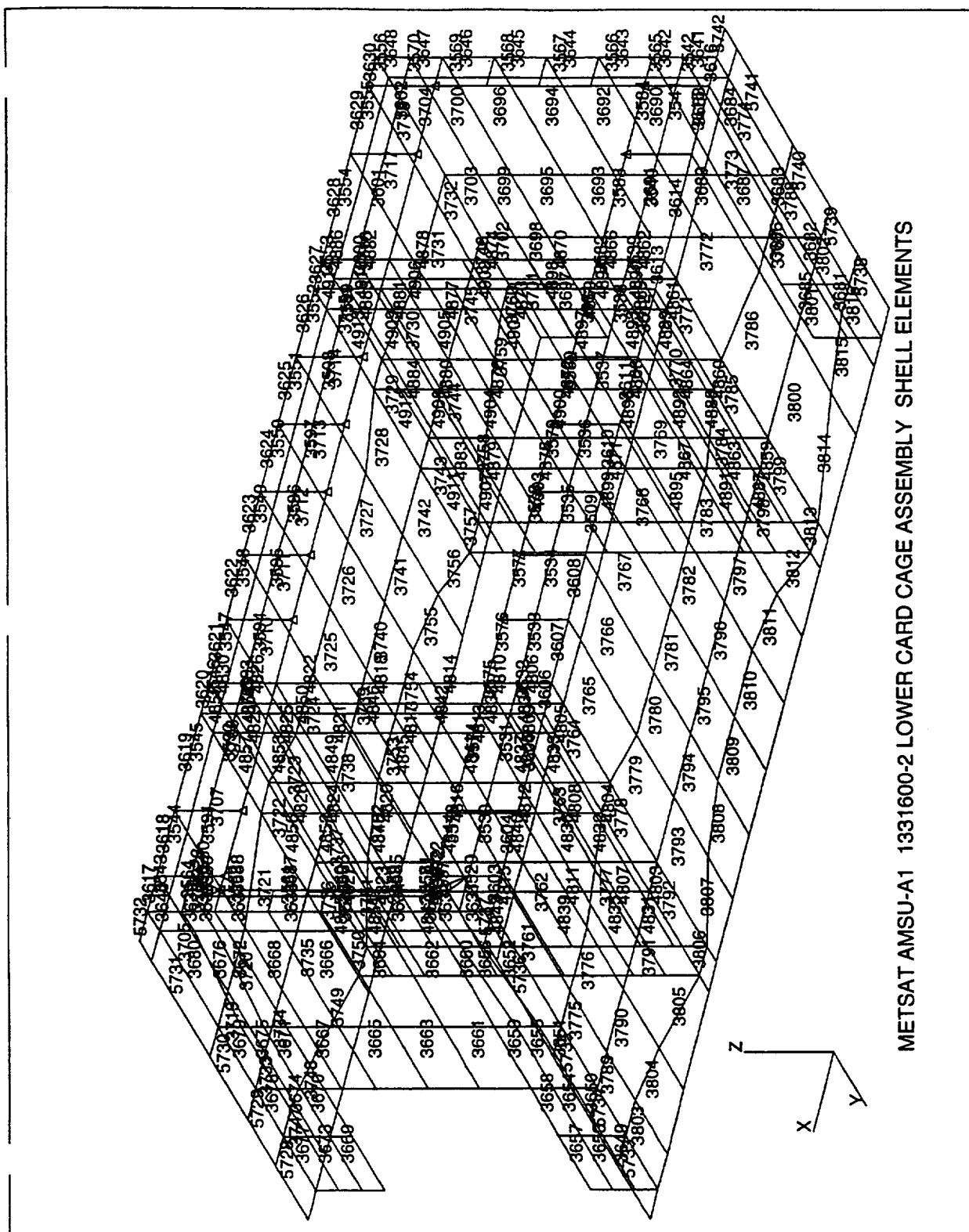


Figure A-81 METSAT AMSU-A1 1331600-2 Lower Card Cage Assembly Shell Assembly

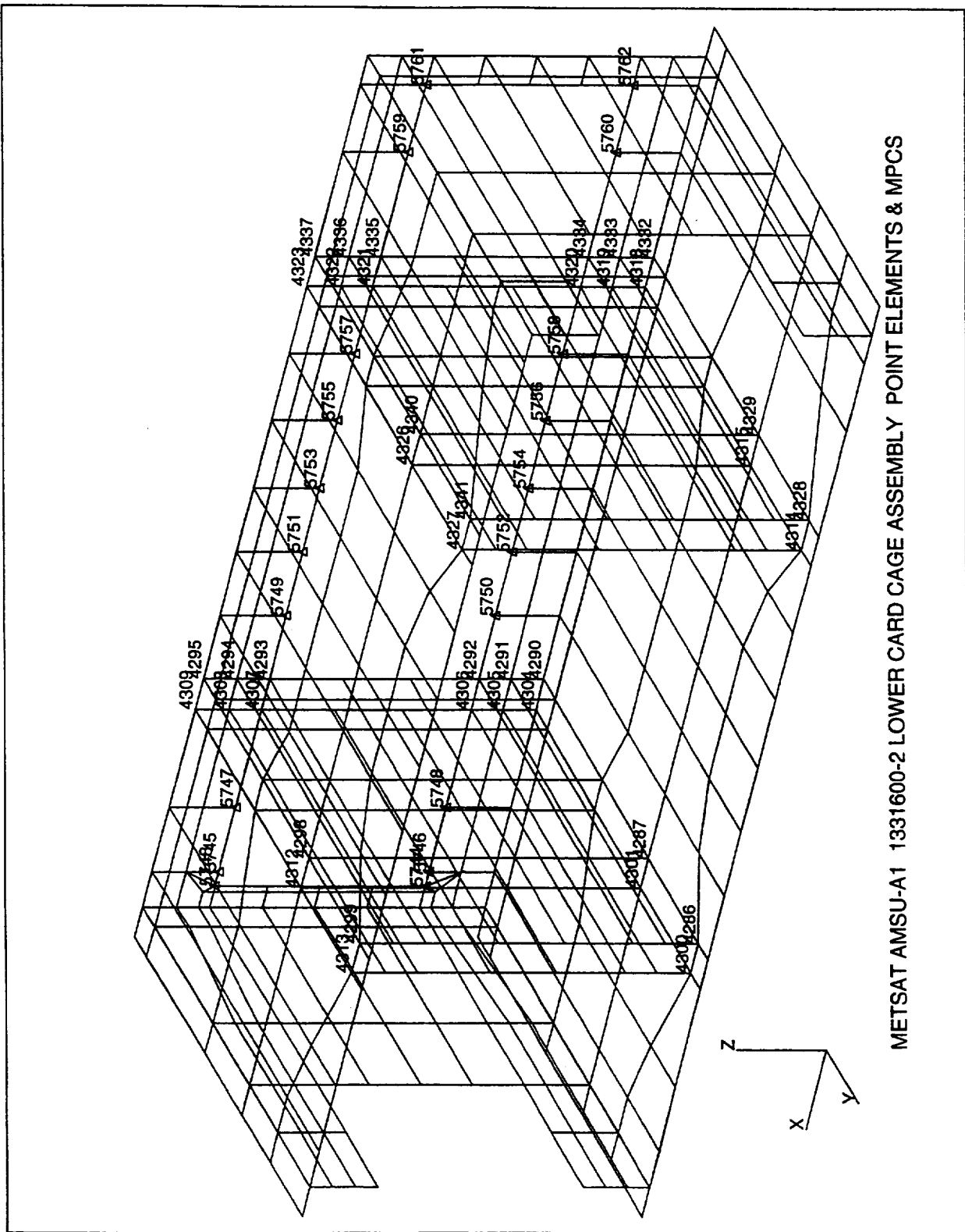


Figure A-82 METSAT AMSU-A1 1331600-2 Lower Card Cage Assembly Point Elements & MPCS

4826	4825	4824	4823	4822
4911	4912	4913	4914	
4839	4840	4841	4842	4821
4907	4908	4909	4910	
4835	4836	4837	4838	4820
4903	4904	4905	4906	
4848	4849	4850	4851	4852
4899	4900	4901	4902	
4843	4844	4845	4846	4847
4895	4896	4897	4898	
4837	4832	4833	4834	4819
4891	4892	4893	4894	
4827	4828	4829	4830	4818
4887	4888	4889	4890	
4813	4814	4815	4816	4817

Y

X

METSAT AMSU-A1 1331600-1 LOWER CARD CAGE CARD 1 - GRIDS & SHELLS

Figure A-83 METSAT AMSU-A1 1331600-1 Lower Card Cage Card 1 Grids & Shells

4786	4785	4784	4783	4782
4883	4884	4885	4886	
4799	4800	4801	4802	4781
4879	4880	4881	4882	
4795	4796	4797	4798	4780
4875	4876	4877	4878	
4808	4809	4810	4811	4812
4871	4872	4873	4874	
4803	4804	4805	4806	4807
4867	4868	4869	4870	
4784	4792	4793	4794	4779
4863	4864	4865	4866	
4787	4788	4789	4790	4778
4859	4860	4861	4862	
4773	4774	4775	4776	4777

Y

K

METSAT AMSU-A1 1331600-1 LOWER CARD CAGE CARD 2 - GRIDS & SHELLS

Figure A-84 METSAT AMSU-A1 1331600-1 Lower Card Cage Card 2 Grids & Shells

4706	4705	4704	4703	4702
4827	4828	4829	4830	4830
4719	4720	4721	4722	4701
4823	4824	4825	4826	4826
4715	4716	4717	4718	4700
4819	4820	4821	4822	
4728	4729	4730	4731	4732
4815	4816	4817	4818	
4723	4724	4725	4726	4727
4811	4812	4813	4814	
4714	4712	4713	4714	4699
4807	4808	4809	4810	
4707	4708	4709	4710	4698
4803	4804	4805	4806	
4693	4694	4695	4696	4697

Y

METSAT AMSU-A1 1331600-1 LOWER CARD CAGE CARD 3 - GRIDS & SHELLS

Figure A-85 METSAT AMSU-A1 1331600-1 Lower Card Cage Card 3 Grids & Shells

4746	4745	4744	4743	4742
4855	4856	4857	4858	
4759	4760	4761	4762	4741
4851	4852	4853	4854	
4755	4756	4757	4758	4740
4847	4848	4849	4850	
4768	4769	4770	4771	4772
4843	4844	4845	4846	
4763	4764	4765	4766	4767
4839	4840	4841	4842	
4754	4752	4753	4754	4739
4835	4836	4837	4838	
4747	4748	4749	4750	4738
4831	4832	4833	4834	
4733	4734	4735	4736	4737

Y

X

METSAT AMSU-A1 1331600-1 LOWER CARD CAGE CARD 4 - GRIDS & SHELLS

Figure A-86 METSAT AMSU-A1 1331600-1 Lower Card Cage Card 4 Grids & Shells

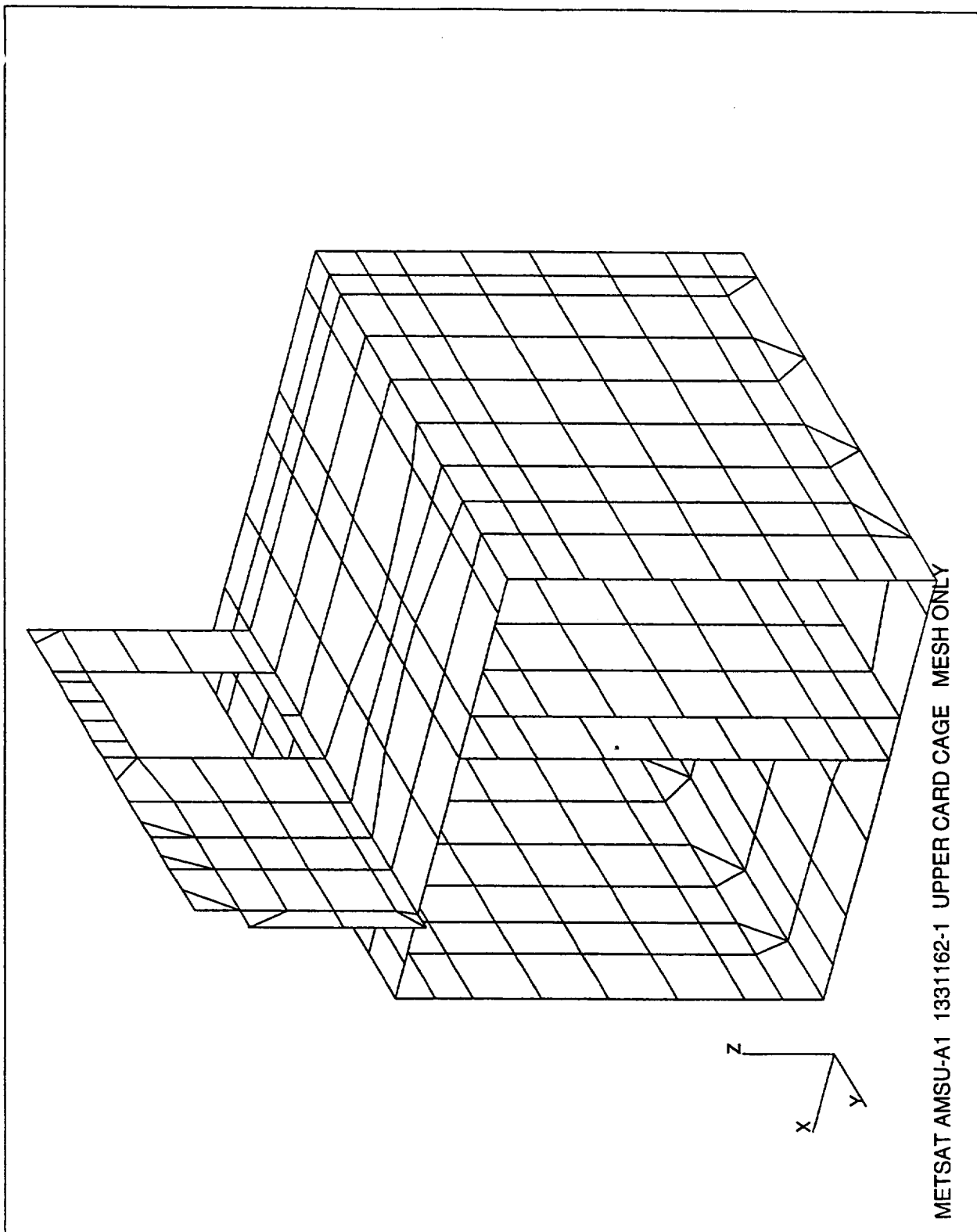


Figure A-87 METSAT AMSU-A1 1331162-1 Upper Card Cage Mesh Only

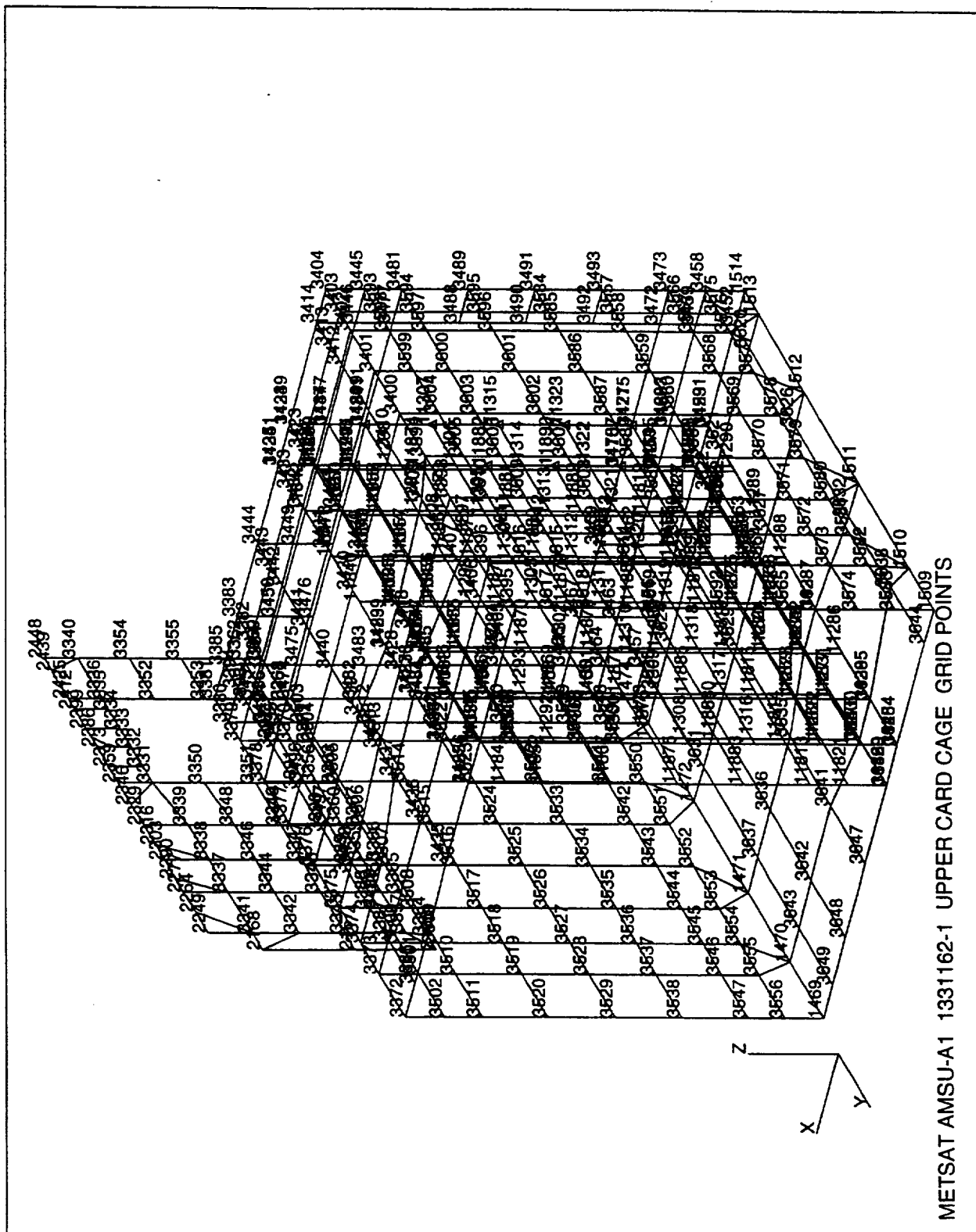


Figure A-88 METSAT AMSU-A1 1331162-1 Upper Card Cage Grid Points

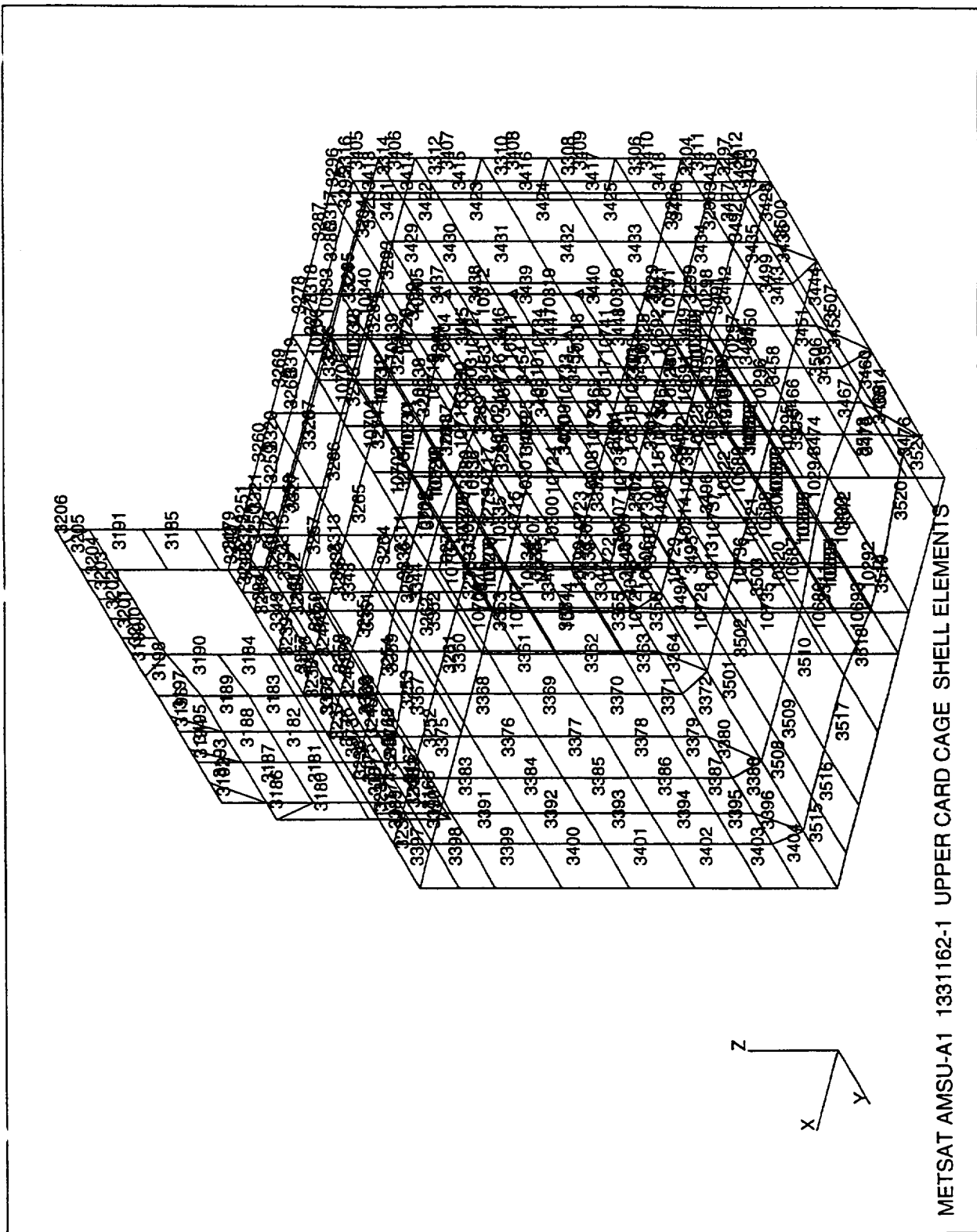


Figure A-89 METSAT AMSU-A1 1331162-1 Upper Card Cage Shell Elements

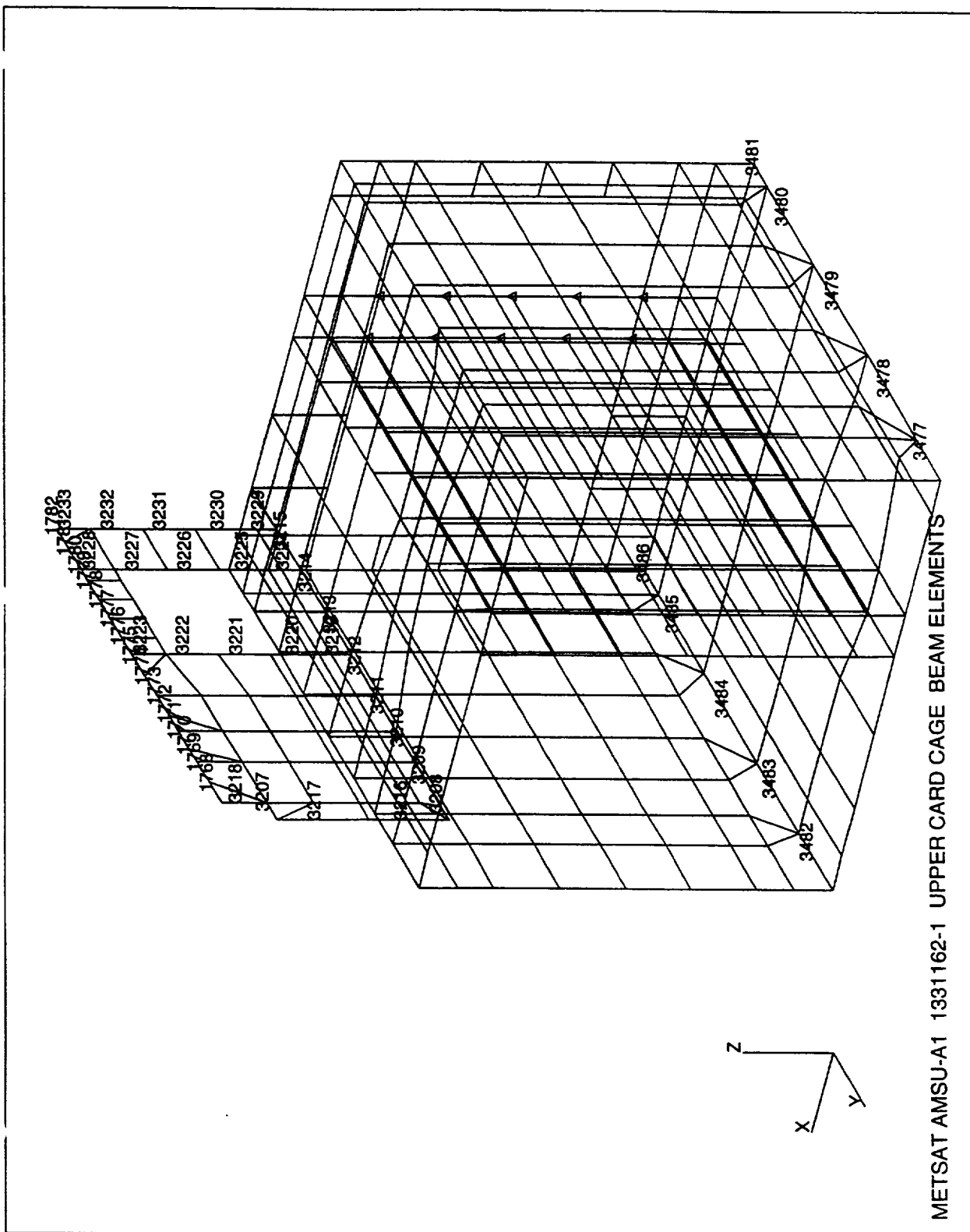


Figure A-90 METSAT AMSU-A1 1331162-1 Upper Card Cage Beam Elements

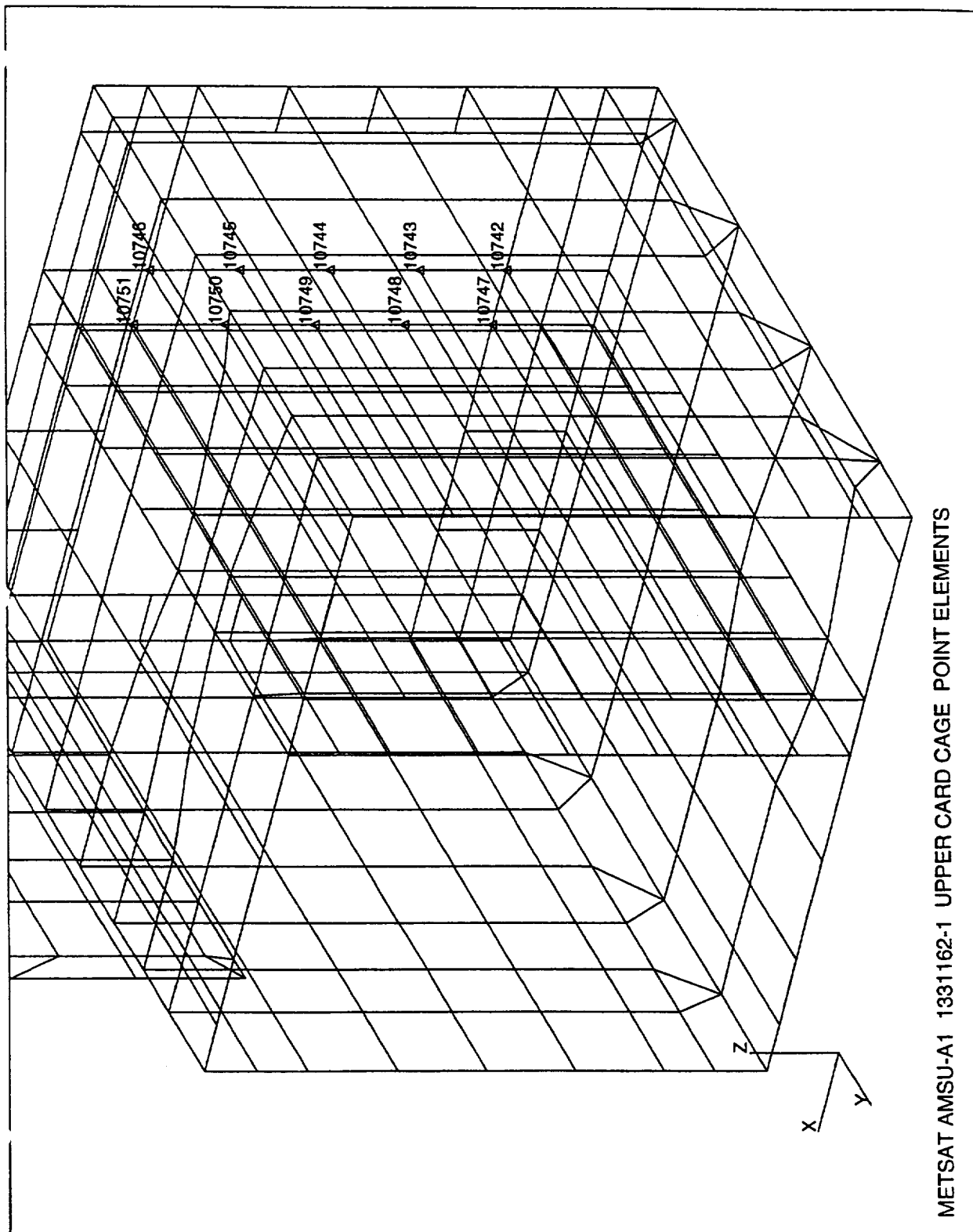


Figure A-91 METSAT AMSU-A1 1331162-1 Upper Card Cage Point Elements

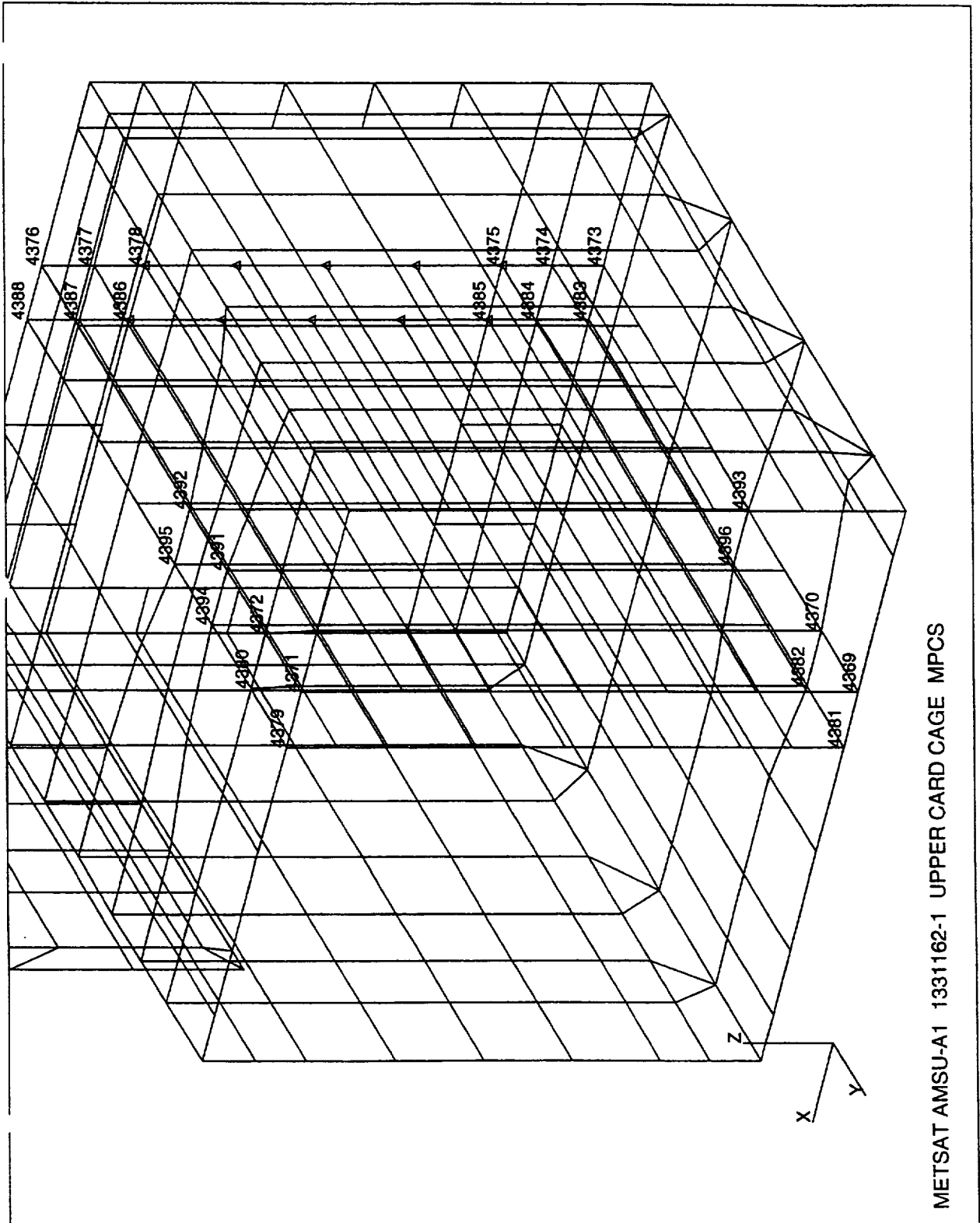


Figure A-92 METSAT AMSU-A1 1331162-1 Upper Card Cage MPCs

11836	11837	11838	11839	11840	11841	11842	11251
10700	10701	10702	10703	10704	10705	10706	
11844	11845	11846	11847	11848	11849	11850	11259
10707	10708	10709	10710	10711	10712	10713	
11852	11853	11854	11855	11856	11857	11858	11211
10714	10715	10716	10717	10718	10719	10720	
11867	11868	11869	11870	11871	11872	11873	11874
10721	10722	10723	10724	10725	10726	10727	
11875	11876	11877	11878	11879	11880	11881	11882
10728	10729	10730	10731	10732	10733	10734	
11883	11884	11885	11886	11887	11888	11889	11890
10735	10736	10737	10738	10739	10740	10741	
11813	11814	11815	11816	11817	11818	11819	11187
10686	10687	10688	10689	10690	10691	10692	
11821	11822	11823	11824	11825	11826	11827	11195
Y	X	10694	10695	10696	10697	10698	
10693	11830	11831	11832	11833	11834	10699	
11829						11835	11203

METSAT AMSU-A1 1331162-1 UPPER CARD CAGE CARD (+X) GRIDS & SHELLS

Figure A-93 METSAT AMSU-A1 1331162-1 Upper Card Cage Card (+X) Grids & Shells

11332	11333	11334	11335	11336	11337	11338	11339
10327	10328	10329	10330	10331	10332	10333	
11340	11341	11342	11343	11344	11345	11346	11347
10334	10335	10336	10337	10338	10339	10340	
11292	11293	11294	11295	11296	11297	11298	11299
10299	10300	10301	10302	10303	10304	10305	
11300	11301	11302	11303	11304	11305	11306	11307
10306	10307	10308	10309	10310	10311	10312	
11308	11309	11310	11311	11312	11313	11314	11315
10313	10314	10315	10316	10317	10318	10319	
11316	11317	11318	11319	11320	11321	11322	11323
10320	10321	10322	10323	10324	10325	10326	
11268	11269	11270	11271	11272	11273	11274	11275
10285	10286	10287	10288	10289	10290	10291	
11276	11277	11278	11279	11280	11281	11282	11283
Y	X	10292	10293	10294	10295	10296	10297
11284	11285	11286	11287	11288	11289	11290	11291

METSAT AMSU-A1 1331162-1 UPPER CARD CAGE CARD (-X) GRIDS & SHELLS

Figure A-94 METSAT AMSU-A1 1331162-1 Upper Card Cage Card (-X) Grids & Shells

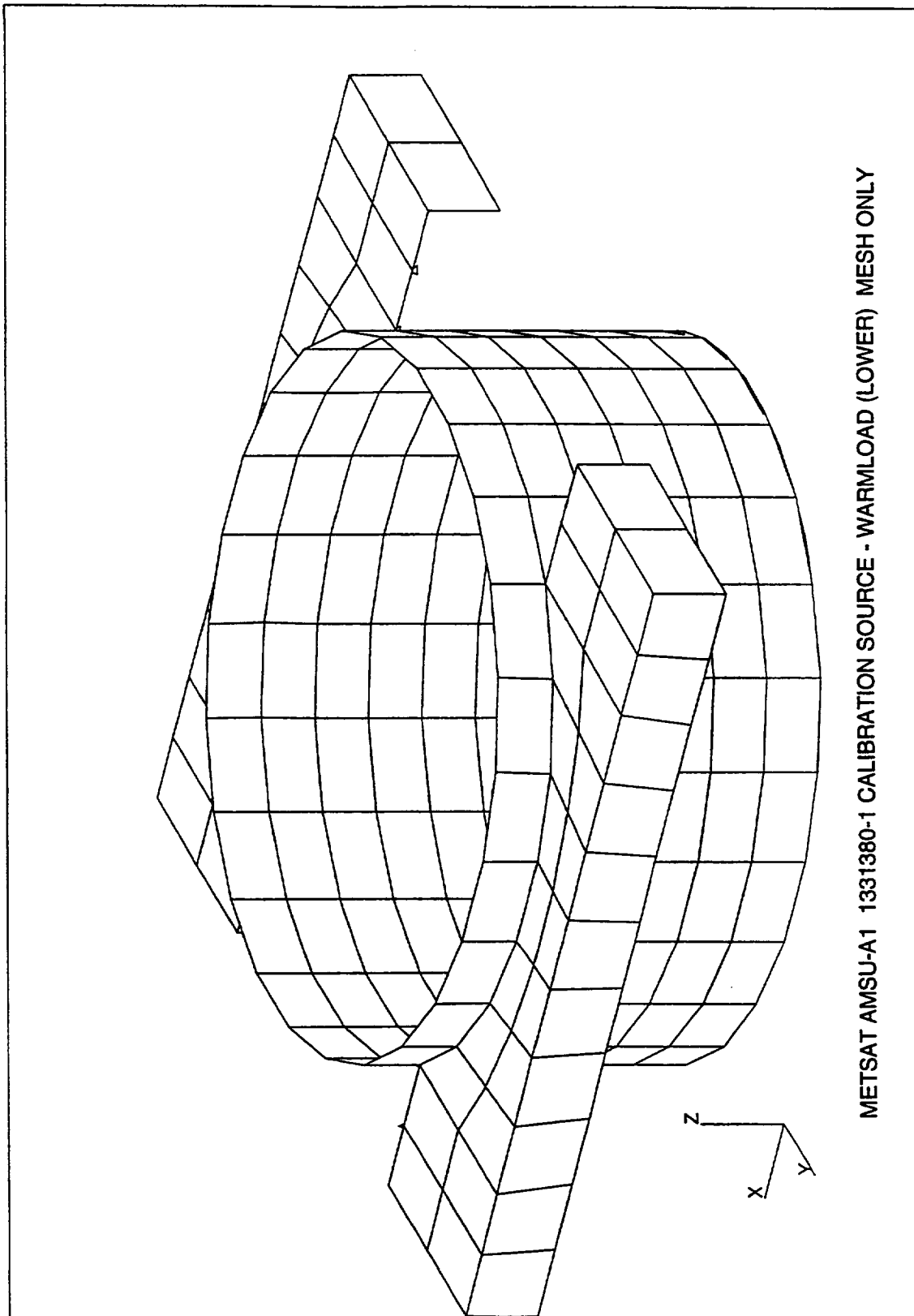


Figure A-95 METSAT AMSU-A1 1331380-1 Calibration Source-Warmload (Lower) Mesh Only

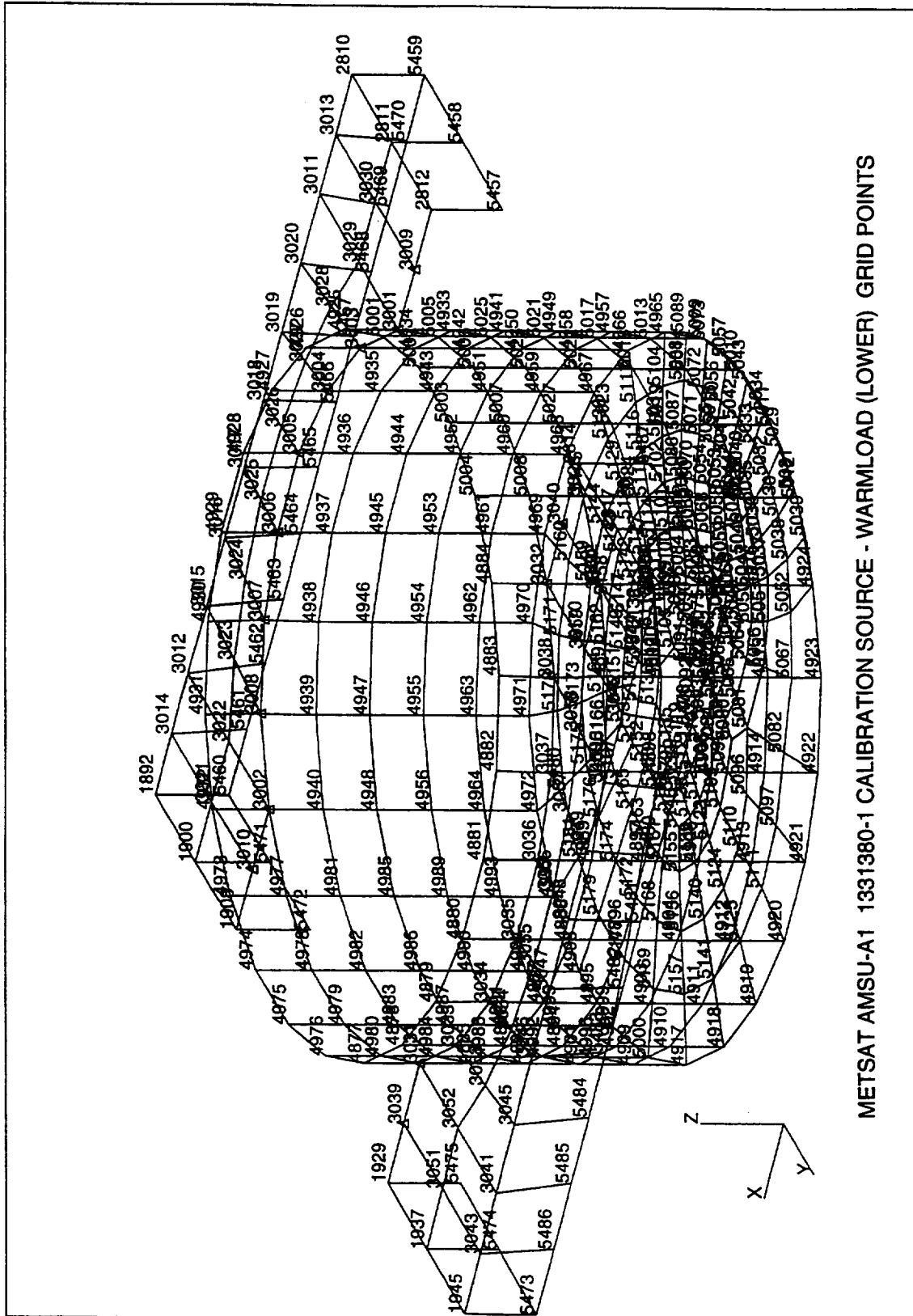
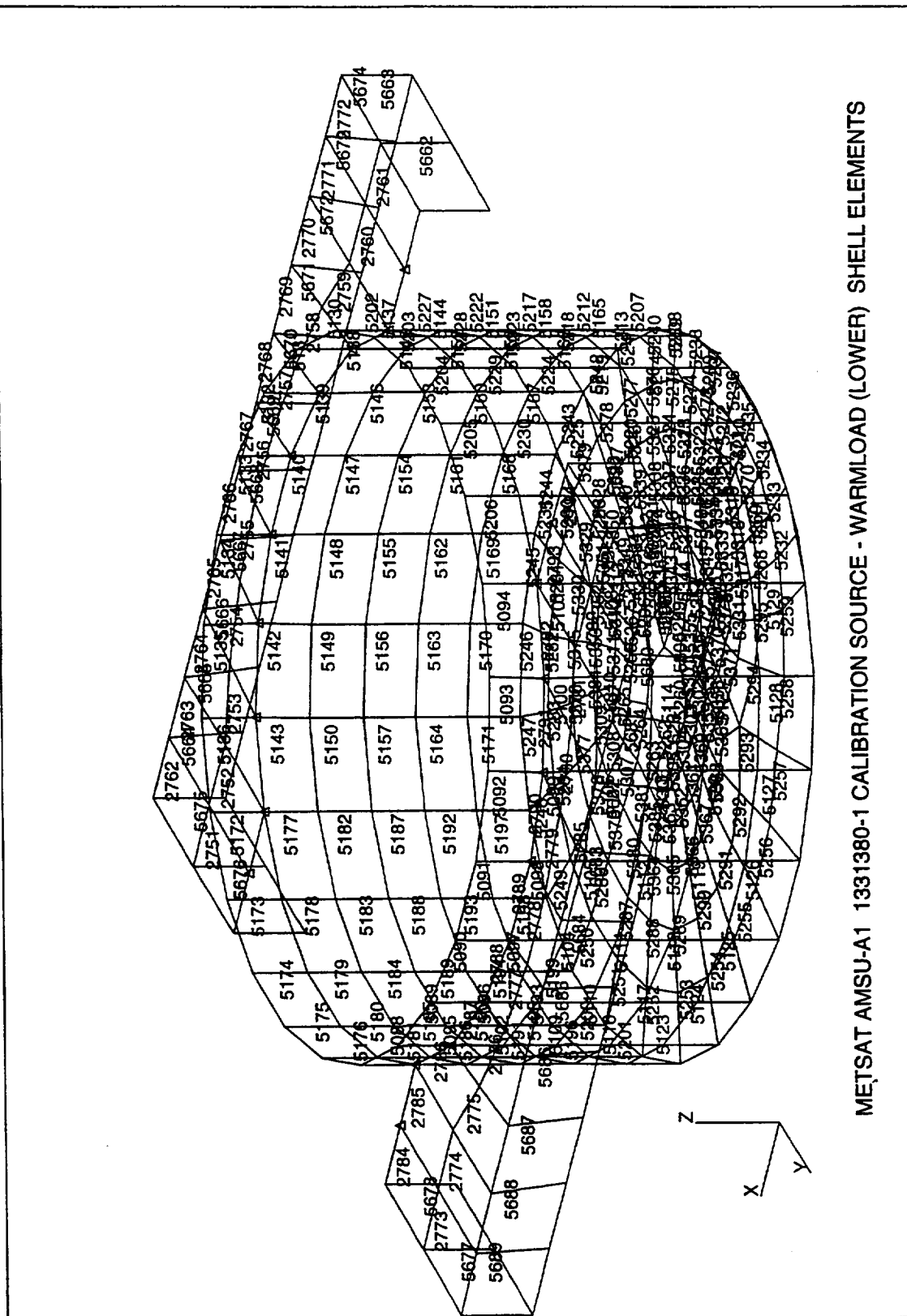


Figure A-96 METSAT AMSU-A1 1331380-1 Calibration Source-Warmload (Lower) Grid Points



METSAT AMSU-A1 1331380-1 CALIBRATION SOURCE - WARMLOAD (LOWER) SHELL ELEMENTS

Figure A-97 METSAT AMSU-A1 1331380-1 Calibration Source-Warmload (Lower) Shell Elements

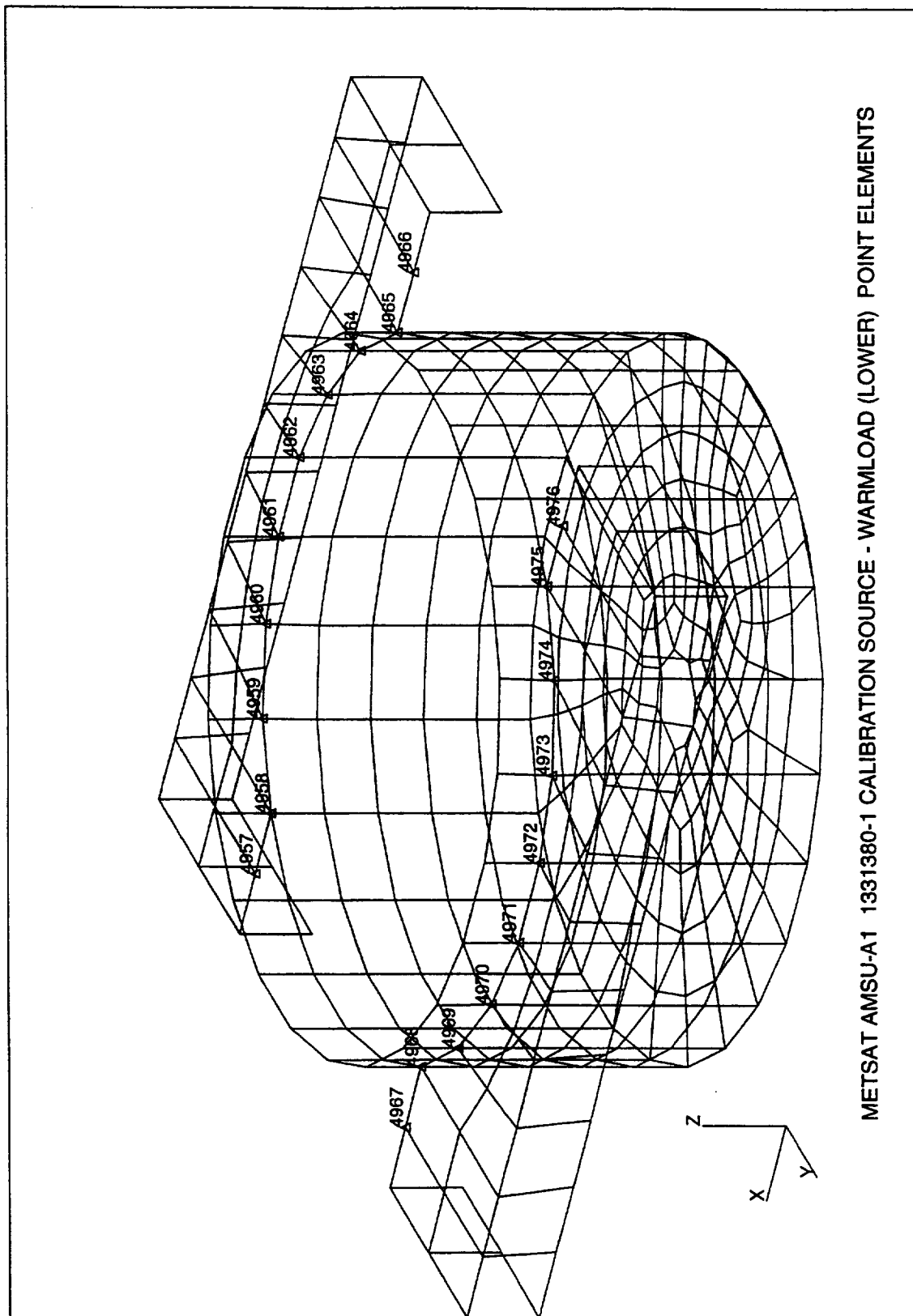


Figure A-98 METSAT AMSU-A1 1331380-1 Calibration Source-Warmload (Lower) Point Elements

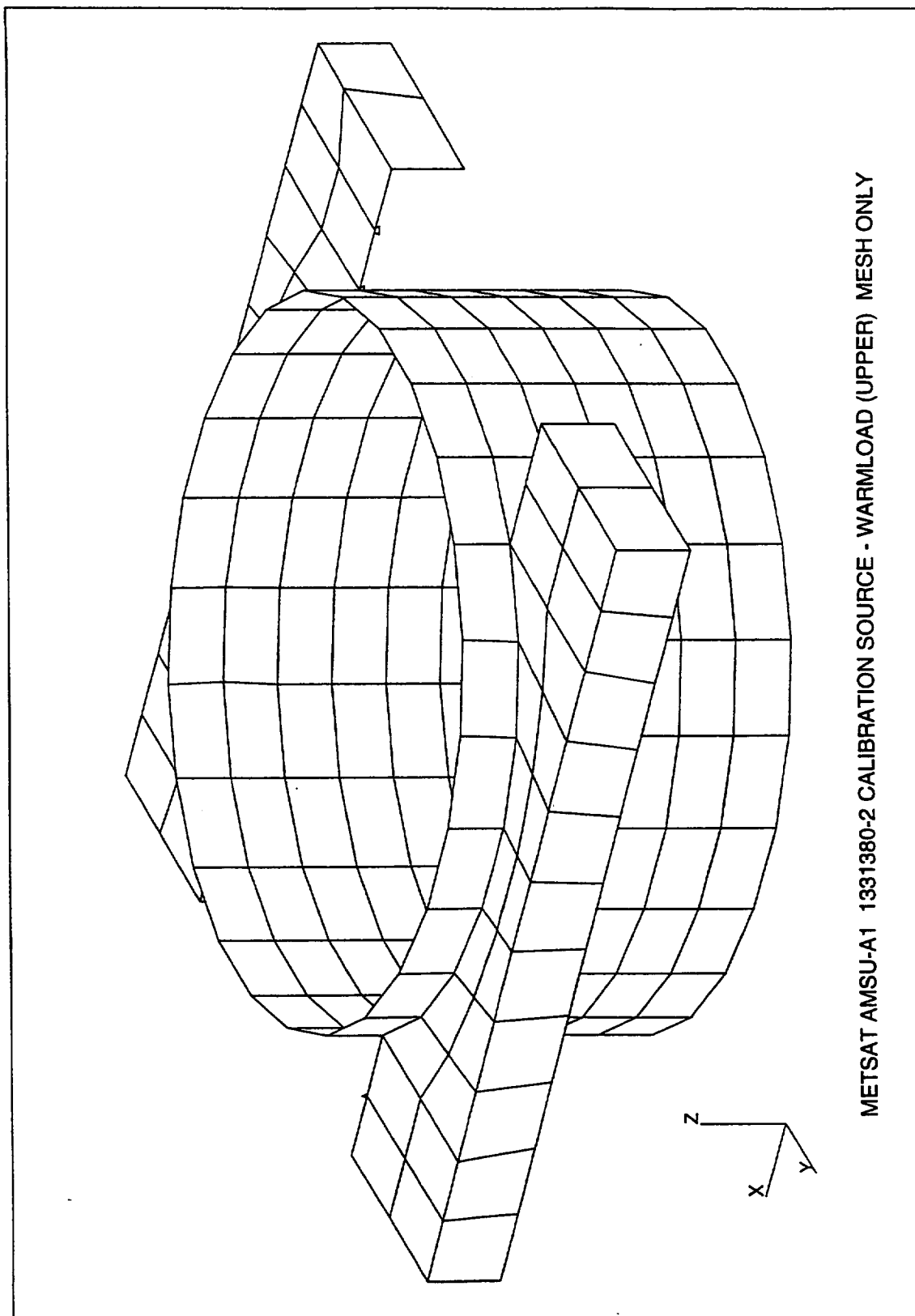


Figure A-99 METSAT AMSU-A1 1331380-2 Calibration Source-Warmload (Upper) Mesh Only

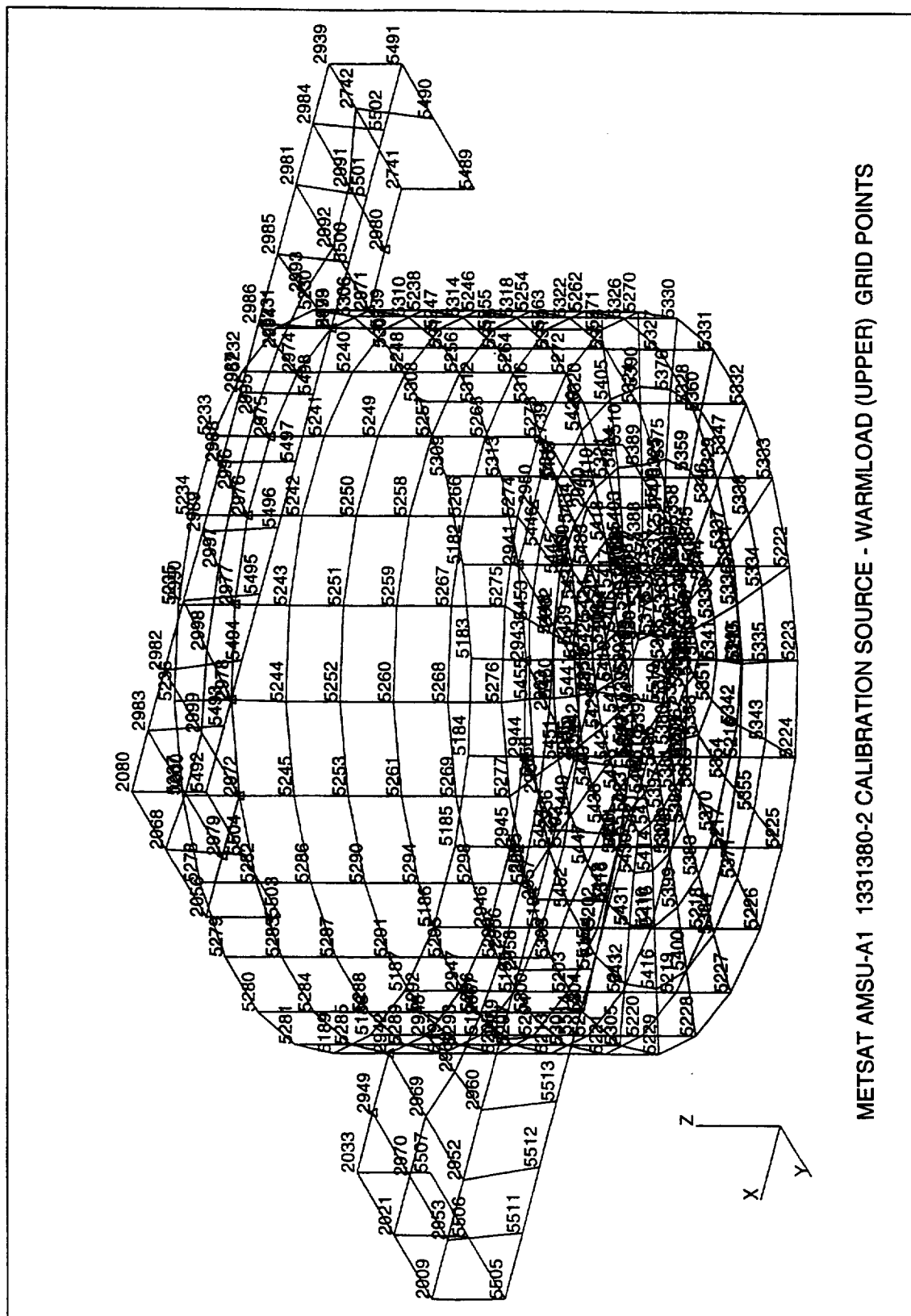


Figure A-100 METSAT AMSU-A1 1331380-2 Calibration Source-Warmload (Upper) Grid Points

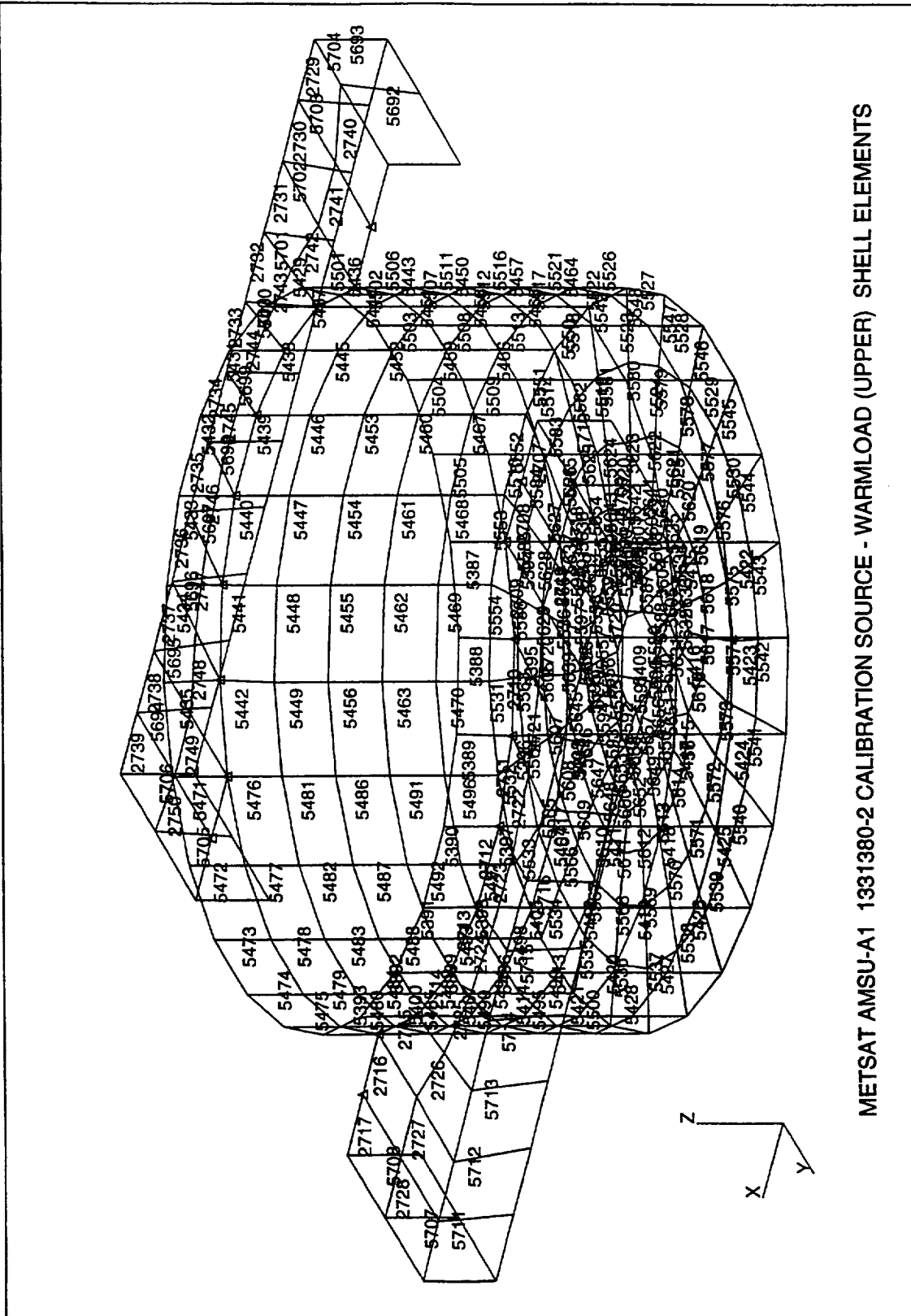


Figure A-101 METSAT AMSU-A1 1331380-2 Calibration Source-Warmload (Upper) Shell Elements

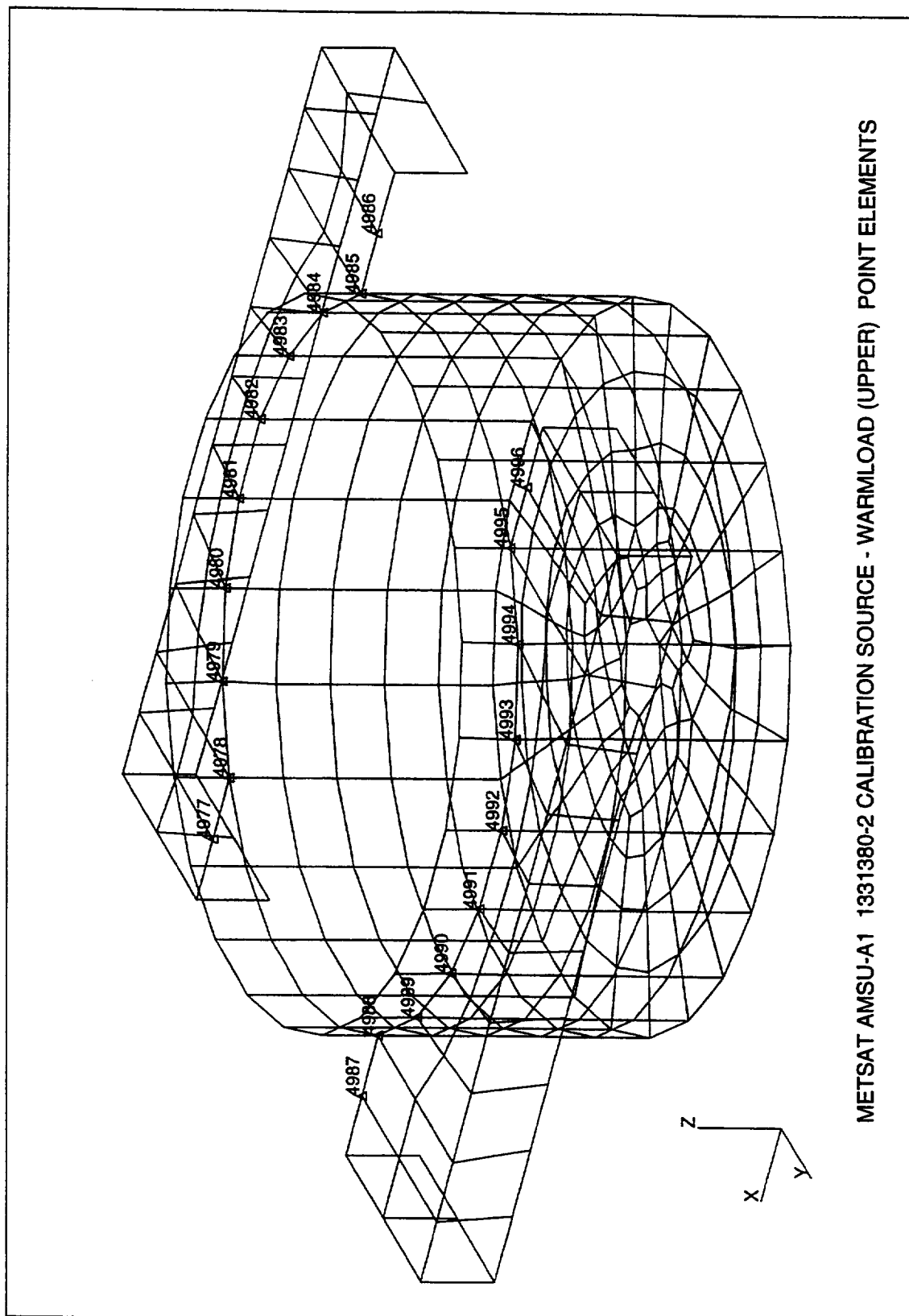


Figure A-102 METSAT AMSU-A1 1331380-2 Calibration Source-Warmload (Upper) Point Elements

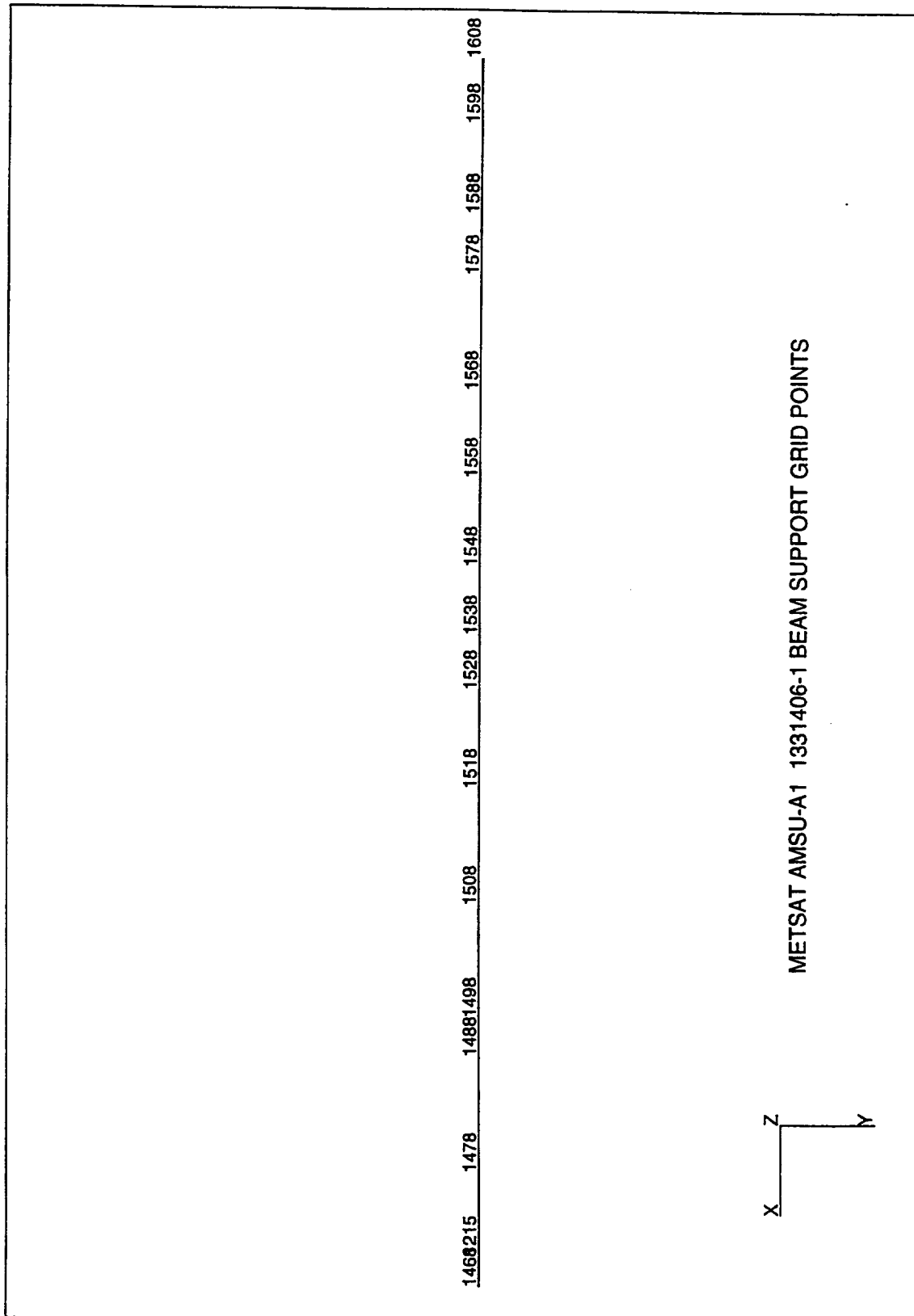


Figure A-103 METSAT AMSU-A1 1331406-1 Beam Support Grid Points

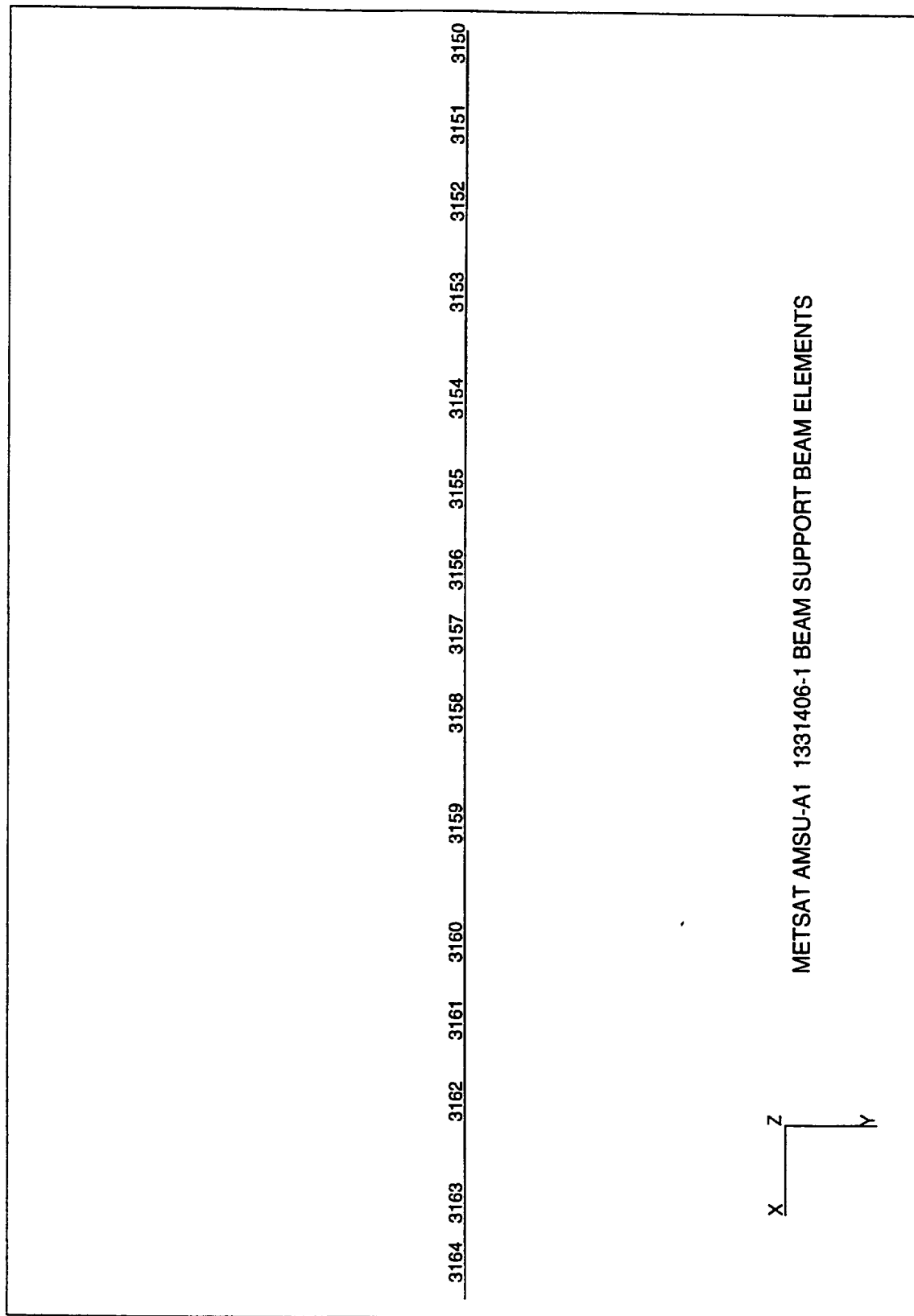


Figure A-104 METSAT AMSU-A1 1331406-1 Beam Support Beam Elements

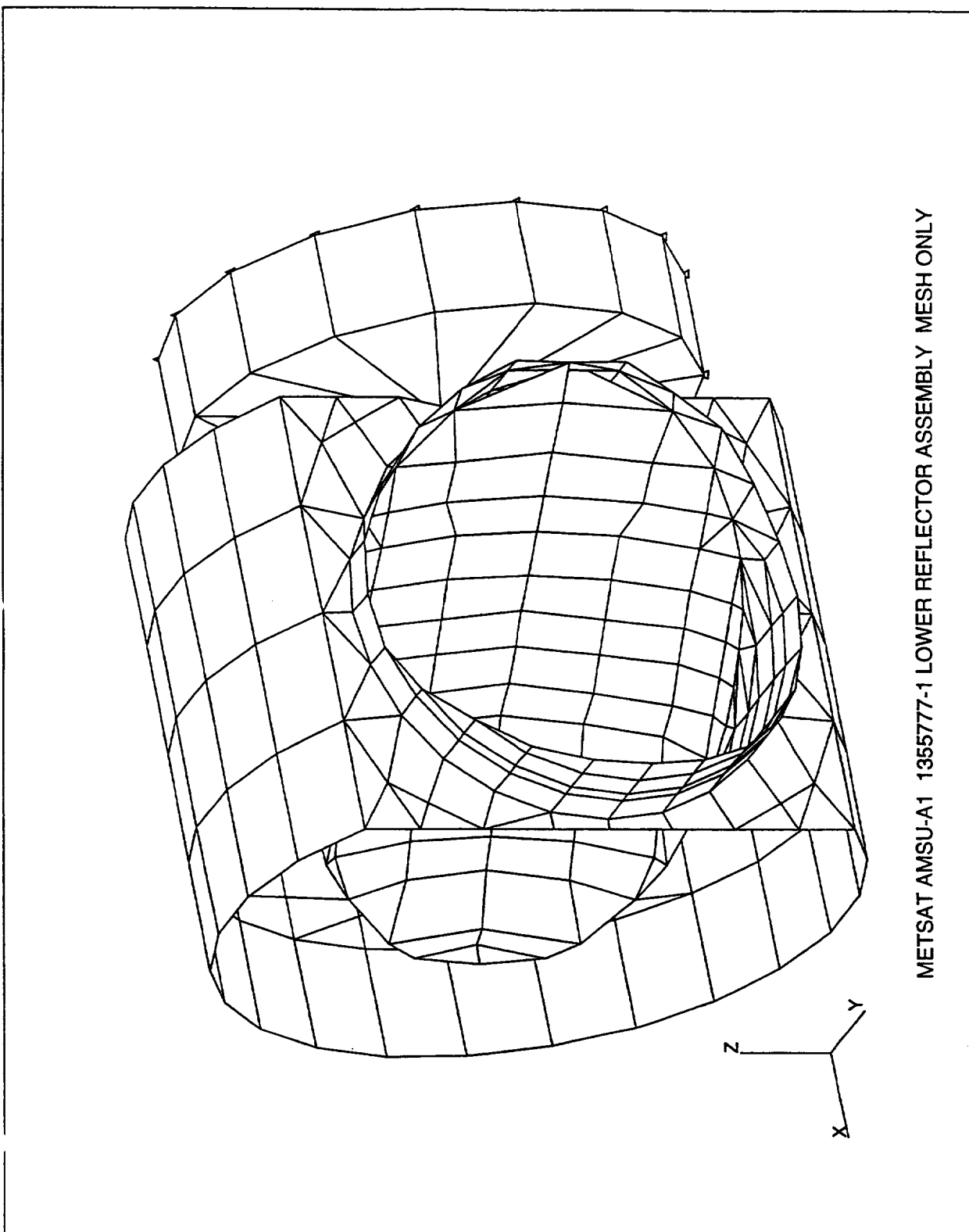


Figure A-105 METSAT AMSU-A1 1355777-1 Lower Reflector Assembly Mesh Only

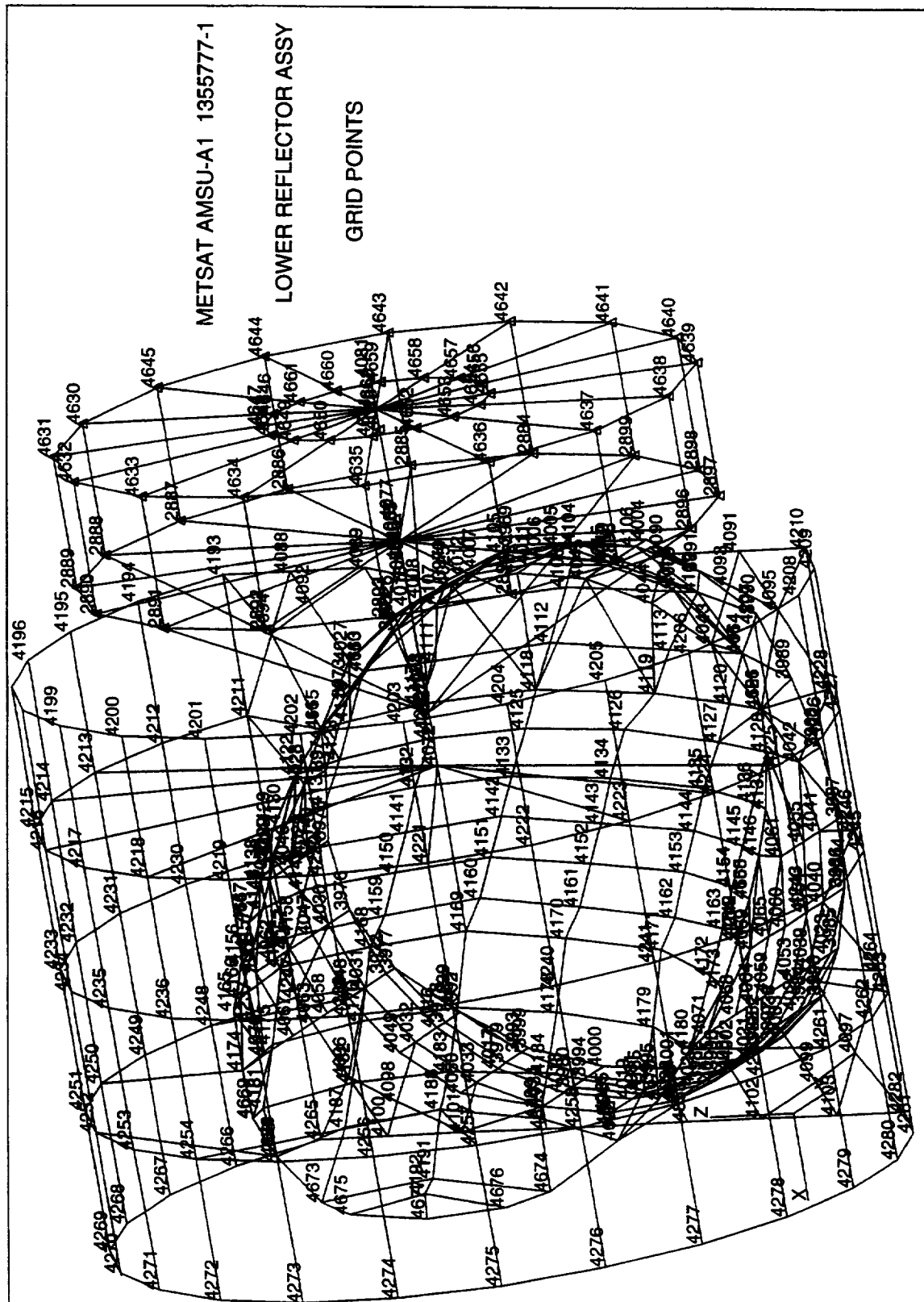


Figure A-106 METSAT AMSU-A1 1355777-1 Lower Reflector Assembly Grid Points

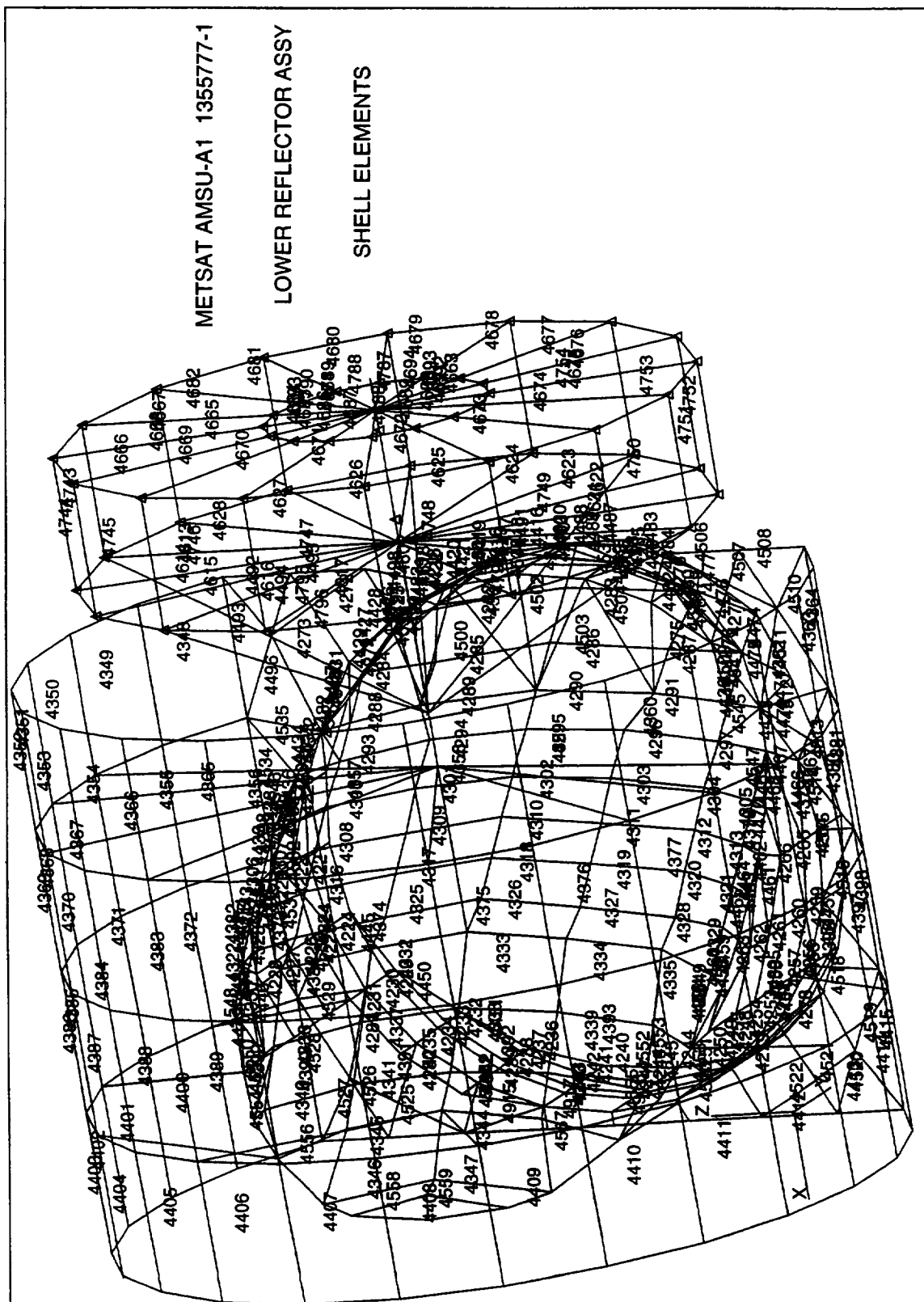


Figure A-107 METSAT AMSU-A1 1355777-1 Lower Reflector Assembly Shell Elements

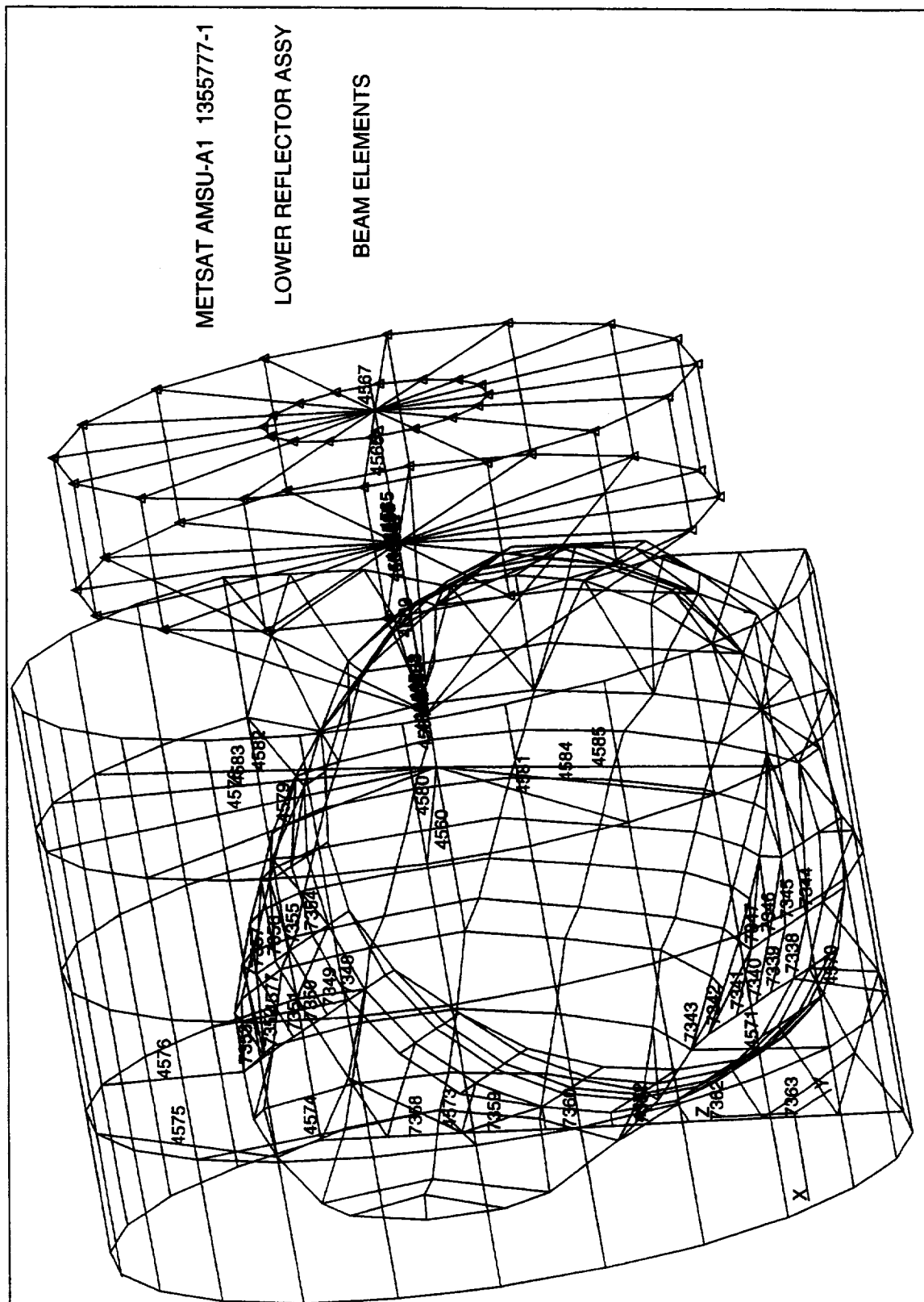


Figure A-108 METSAT AMSU-A1 1355777-1 Lower Reflector Assembly Beam Elements

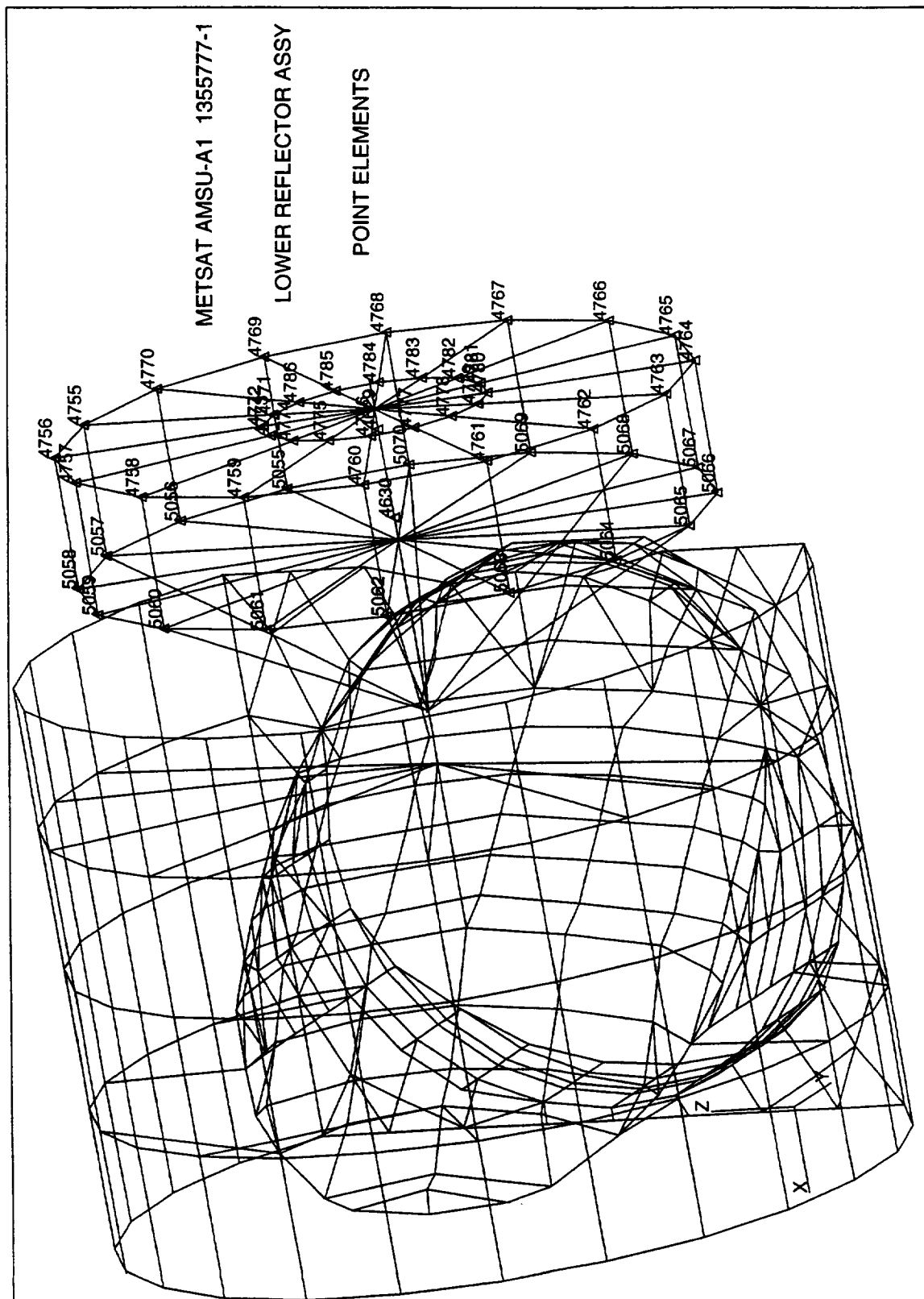


Figure A-109 METSAT AMSU-A1 1355777-1 Lower Reflector Assembly Point Elements

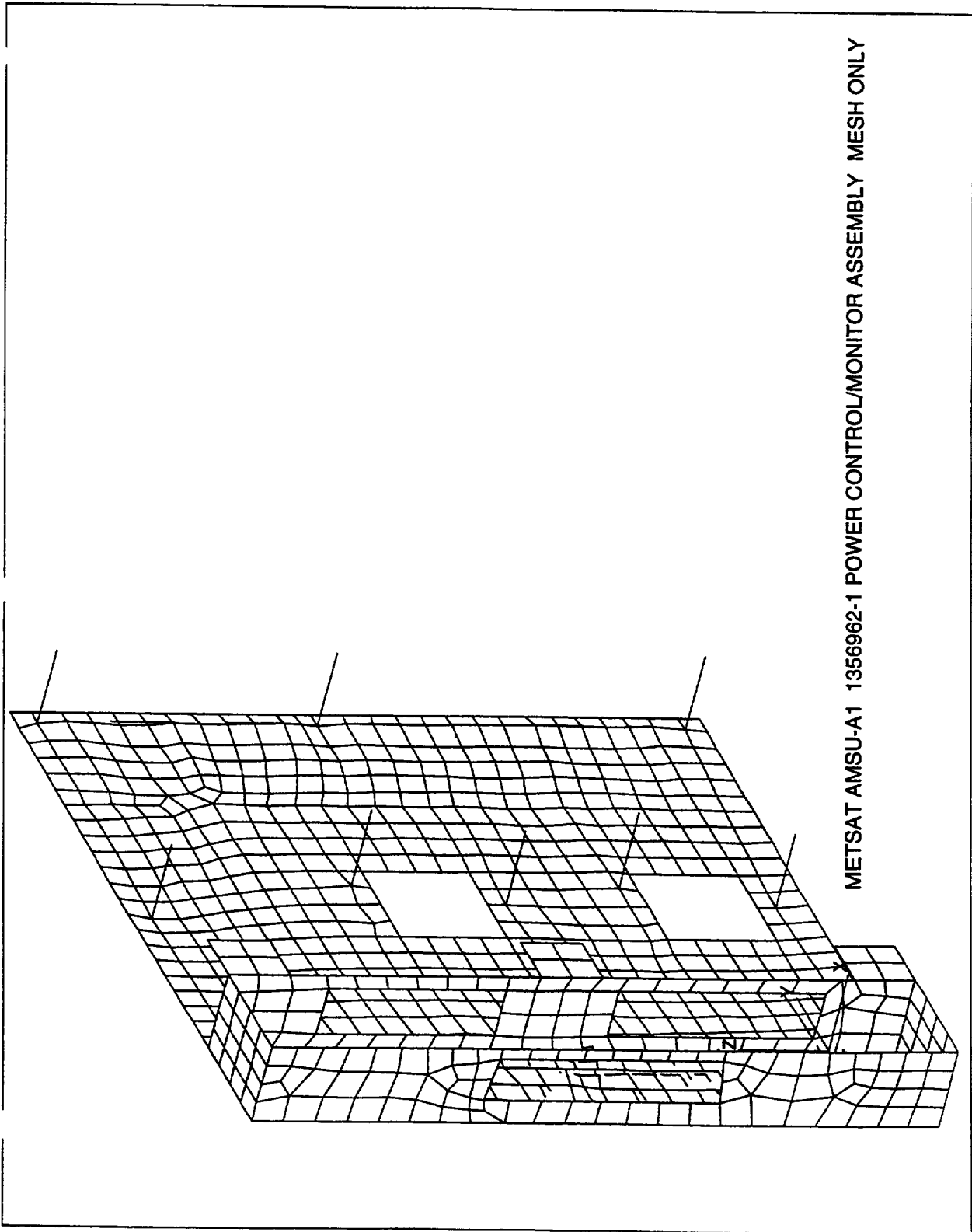


Figure A-110 METSAT AMSU-A1 1356962-1 Power Control/Monitor Assembly Mesh Only

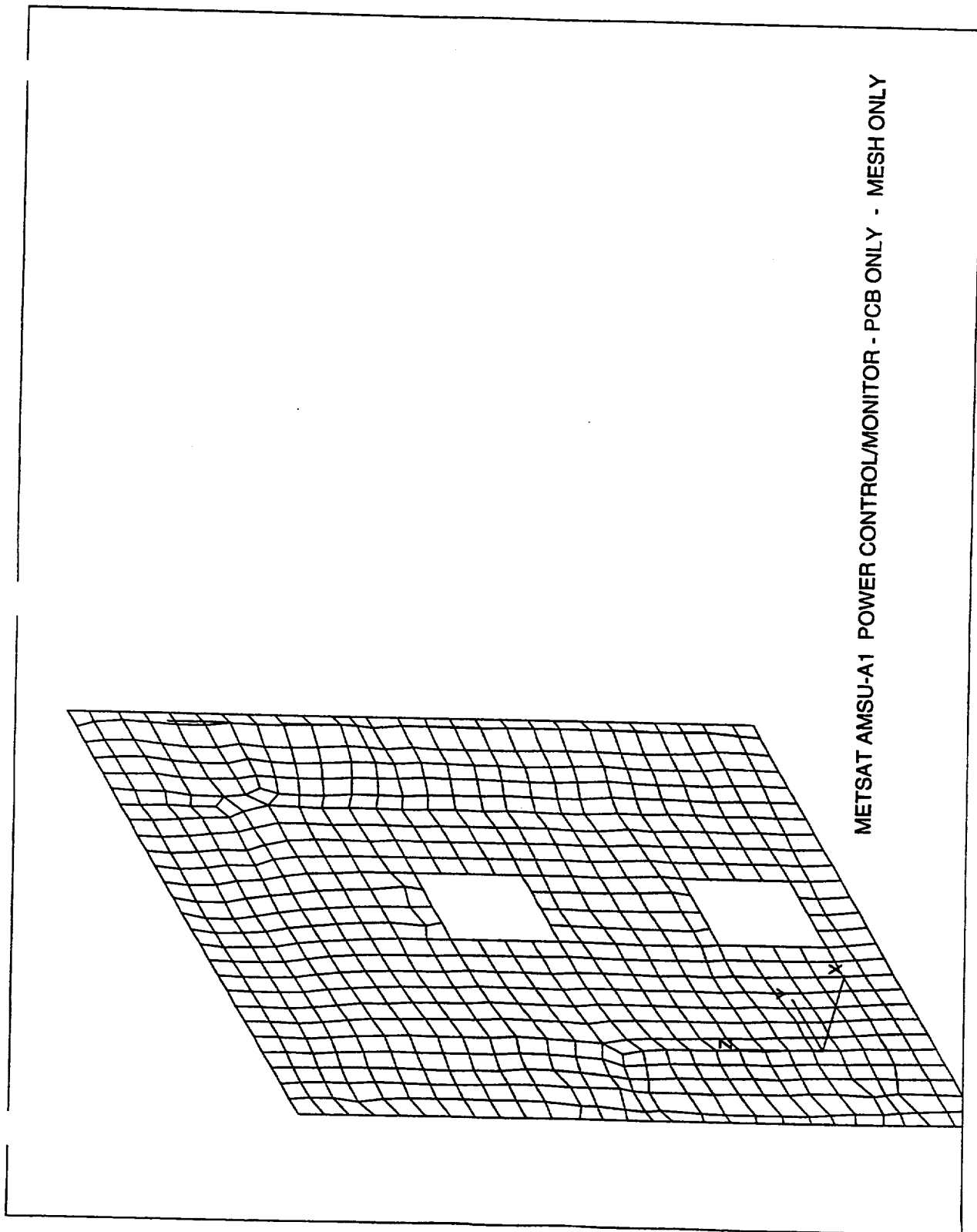


Figure A-111 METSAT AMSU-A1 Power Control/Monitor - PCB Only - Mesh Only

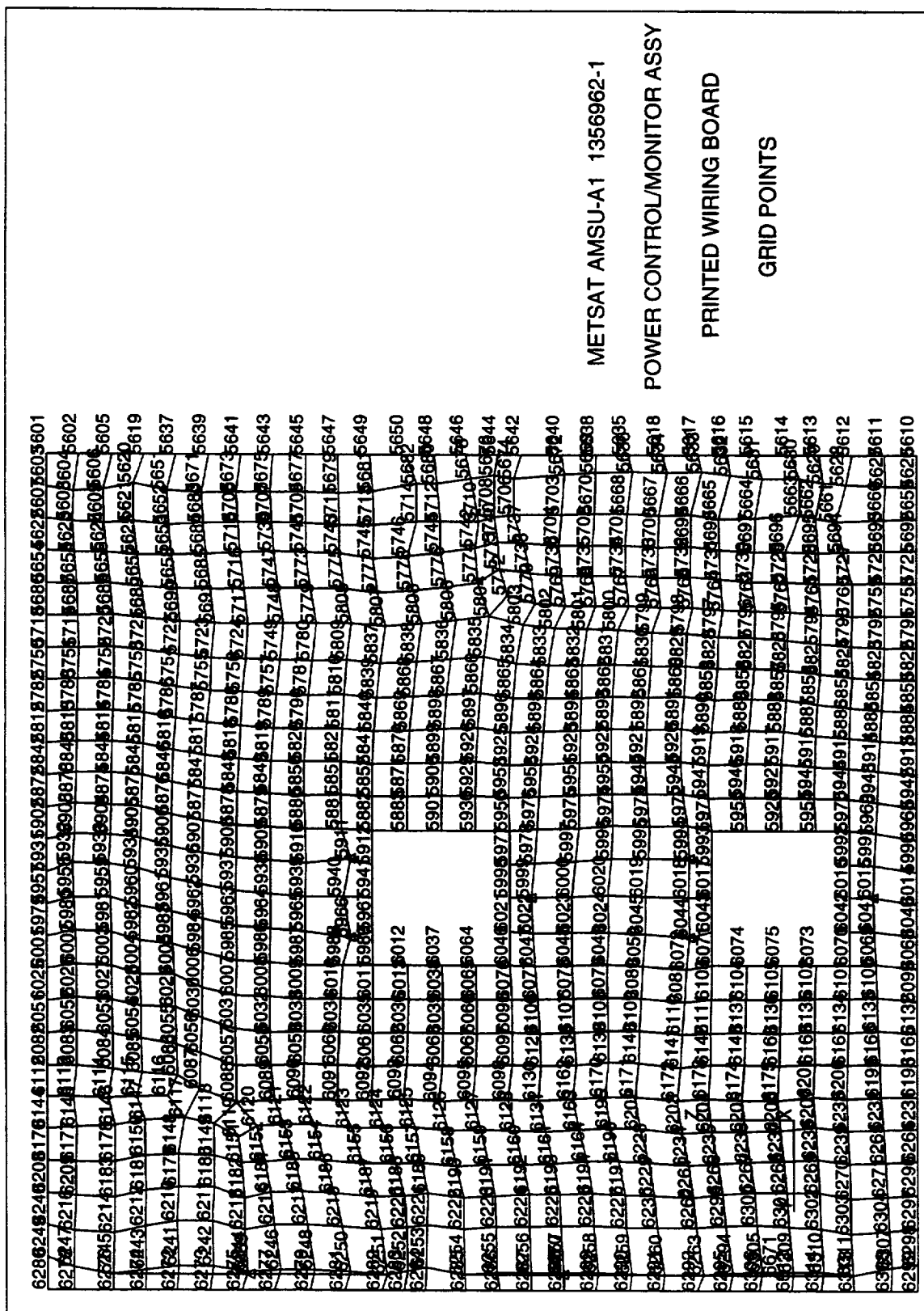


Figure A-112 METSAT AMSU-A1 1356962-1 Power Control/Monitor Assembly Printed Wiring Board Grid Points

[illegible]

A-111

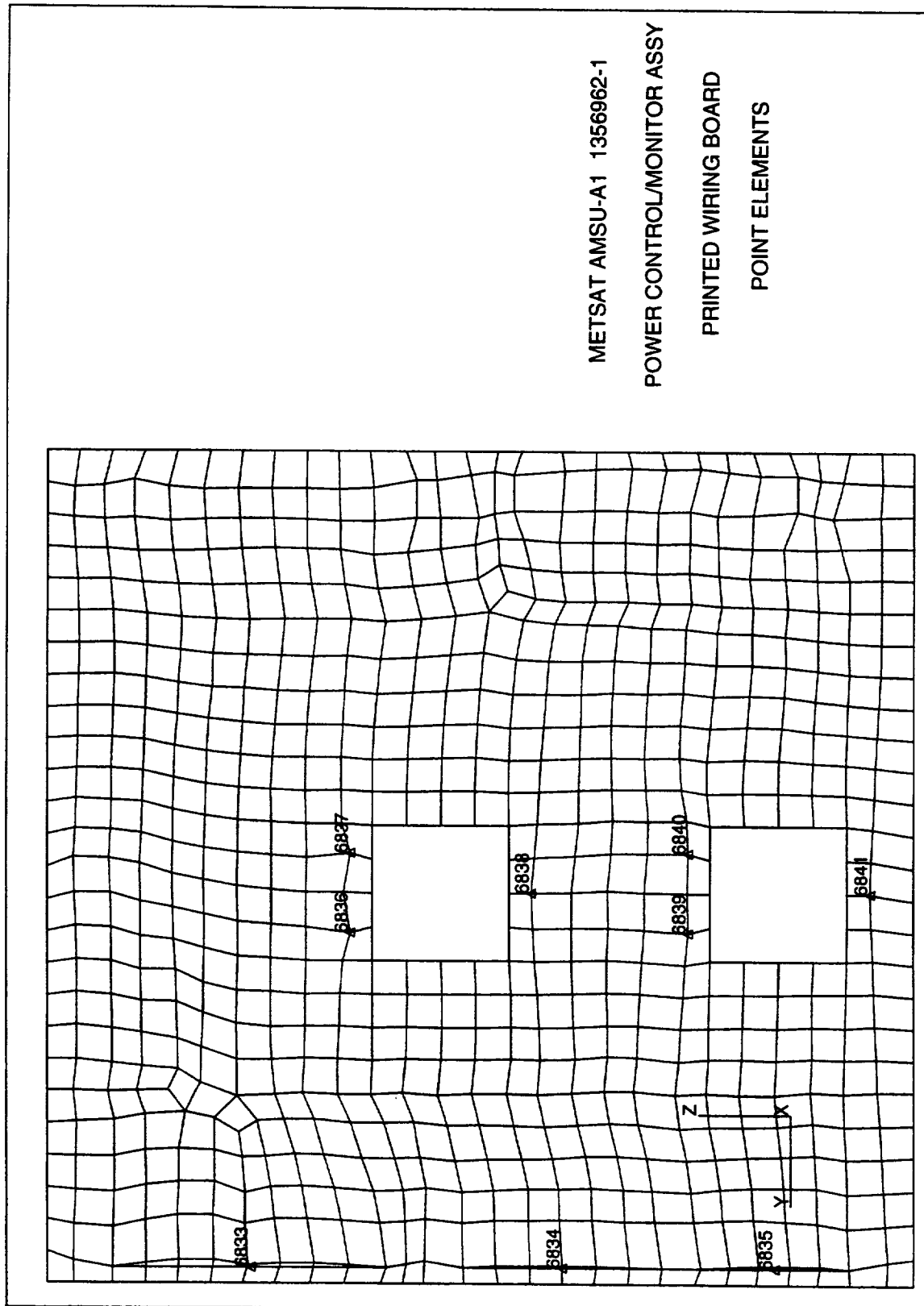


Figure A-114 METSAT AMSU-A1 1356962-1 Power Control/Monitor Assembly Printed Wiring Board Point Elements

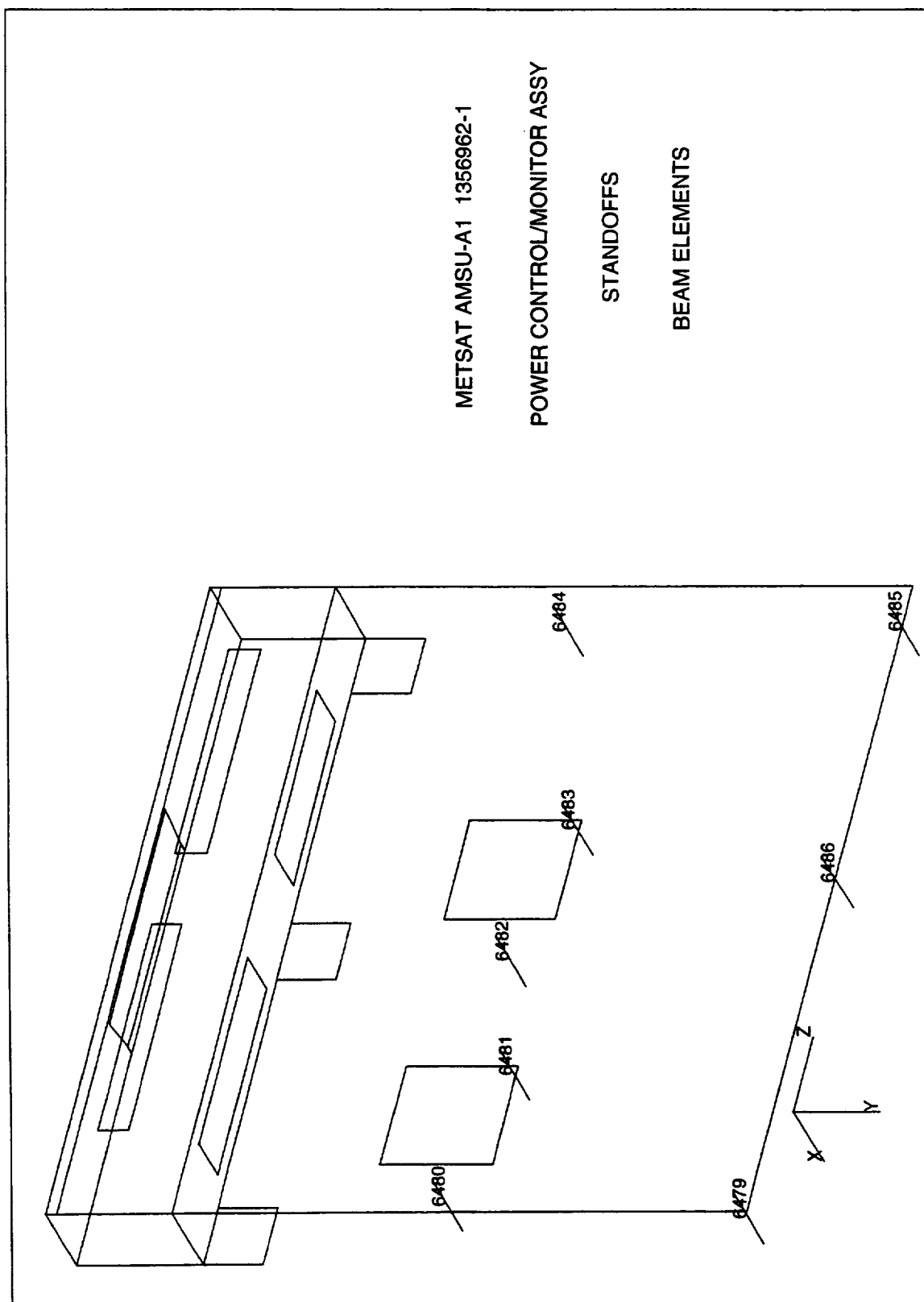


Figure A-115 METSAT AMSU-A1 1356962-1 Power Control/Monitor Assembly Standoffs Beam Elements

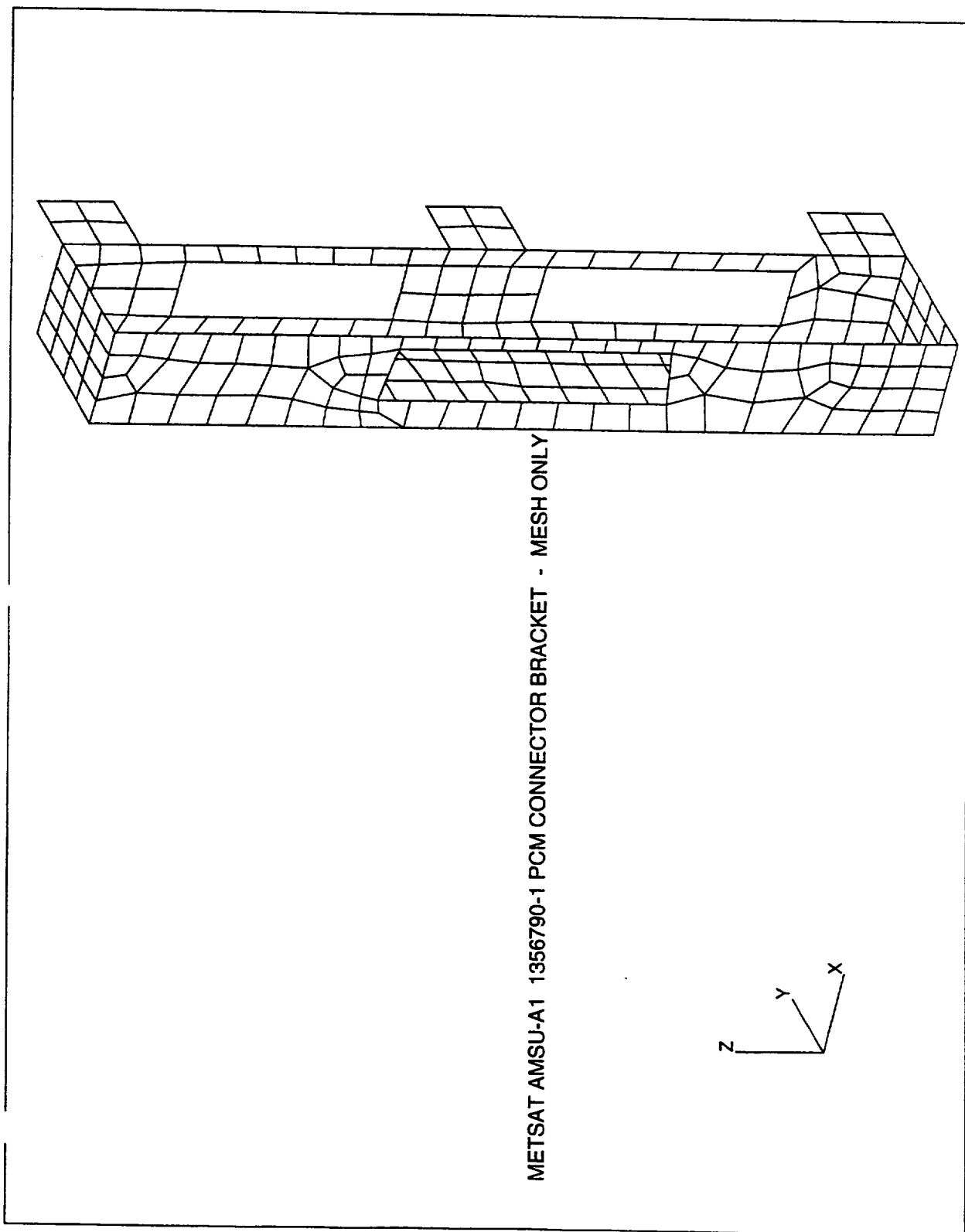


Figure A-116 METSAT AMSU-A1 1356790-1 PCM Connector Bracket Mesh Only

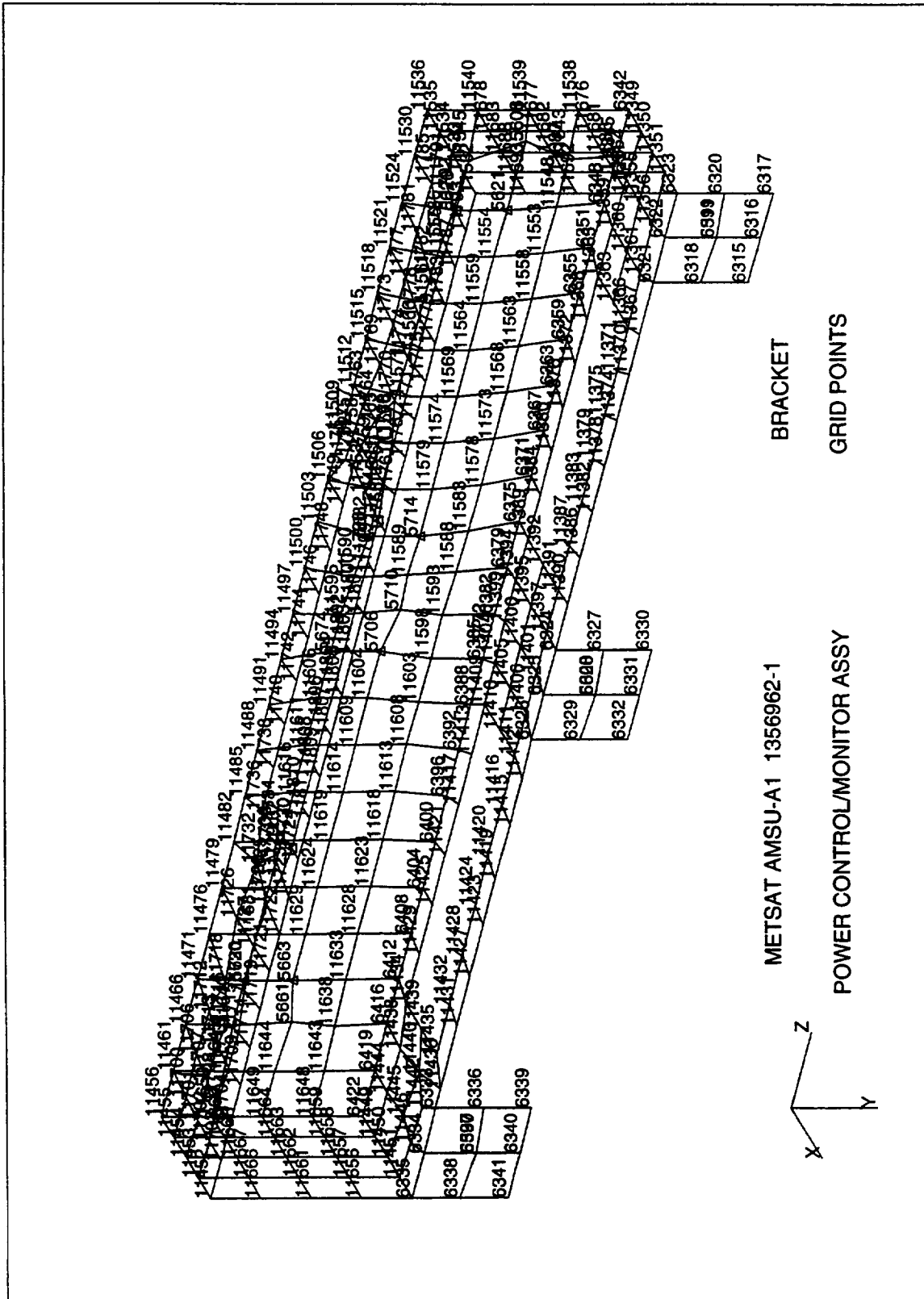


Figure A-117 METSAT AMSU-A1 1356962-1 Bracket Power Control/Monitor Assembly Grid Points

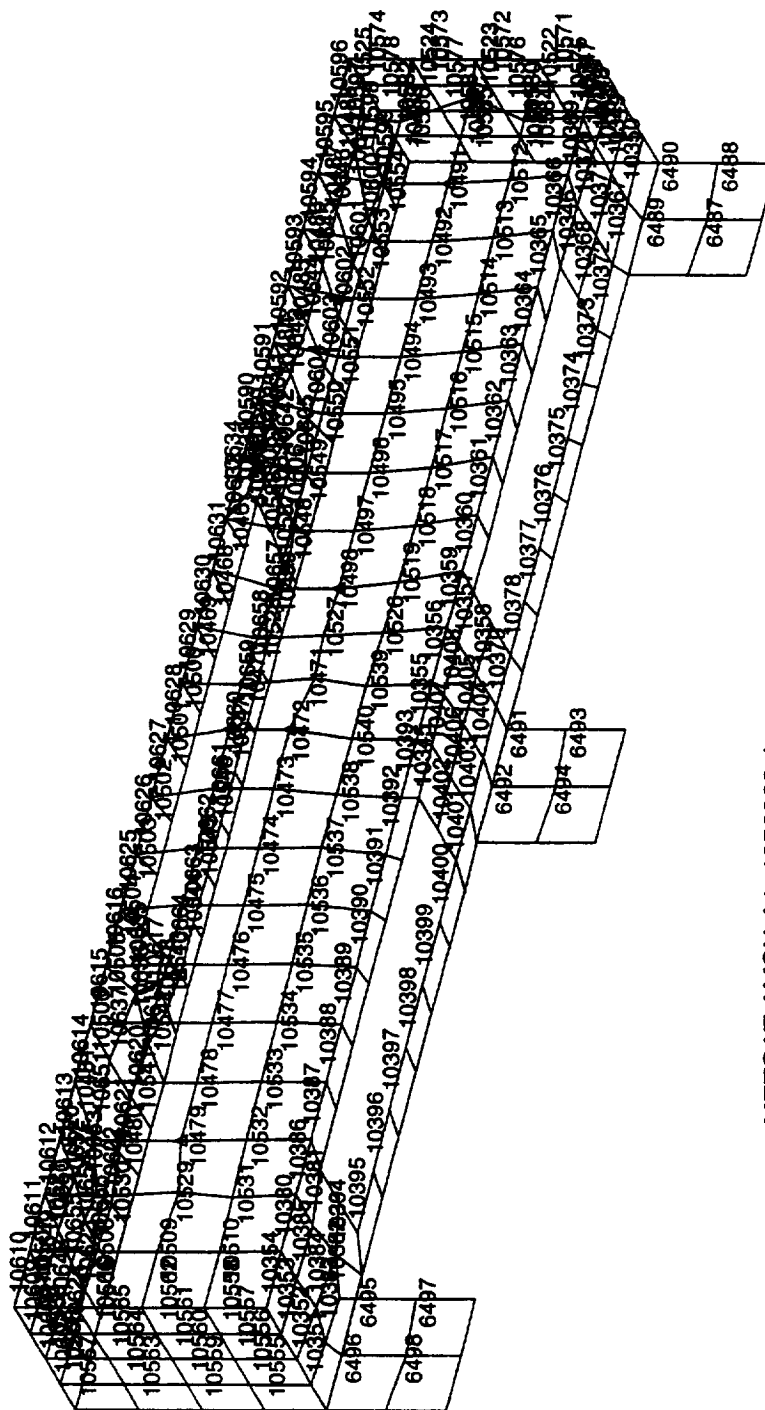


Figure A-118 METSAT AMSU-A1 1356962-1 Bracket Power Control/Monitor Assembly Shell Elements

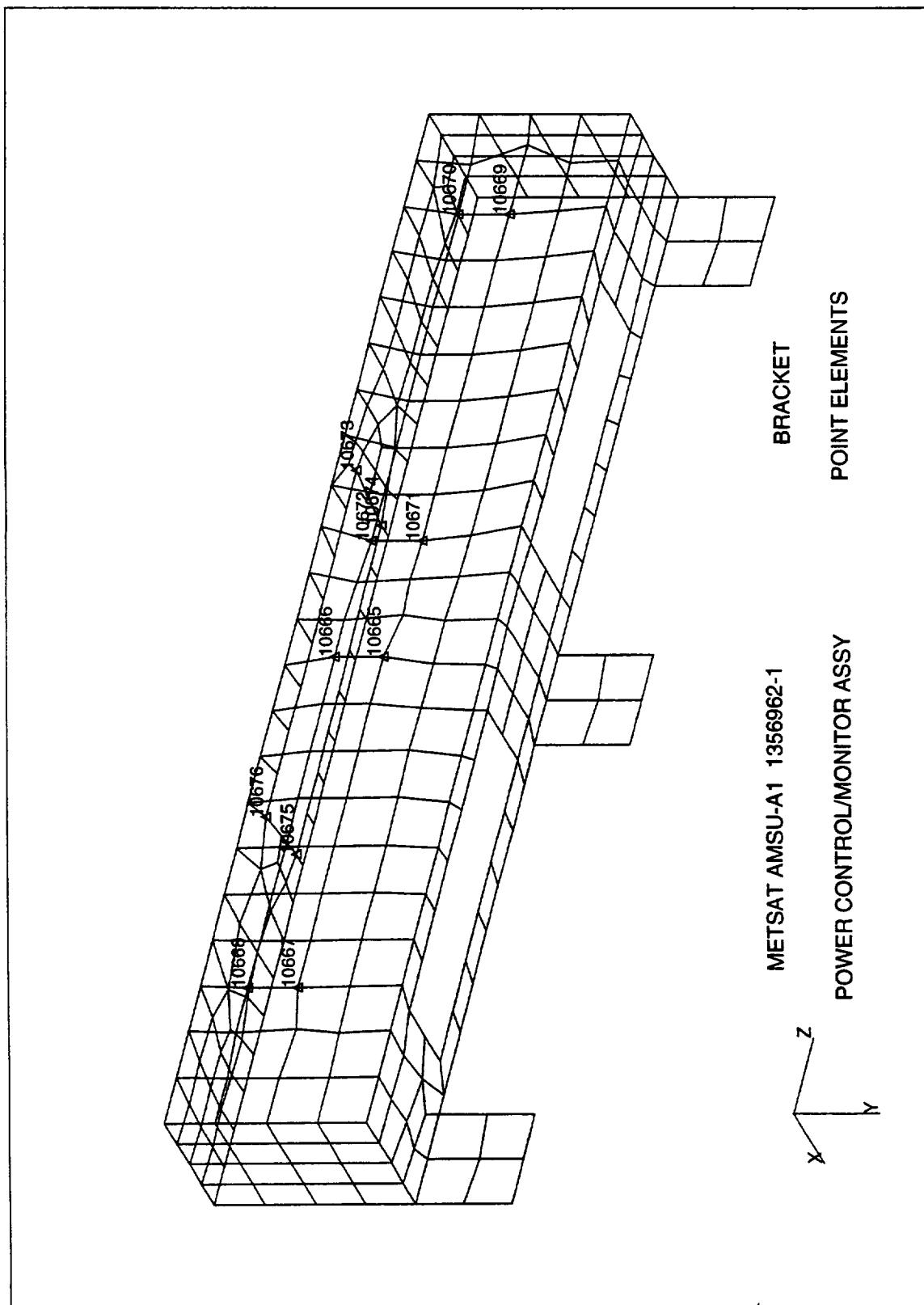


Figure A-119 METSAT AMSU-A1 1356962-1 Bracket Power Control/Monitor Assembly Point Elements

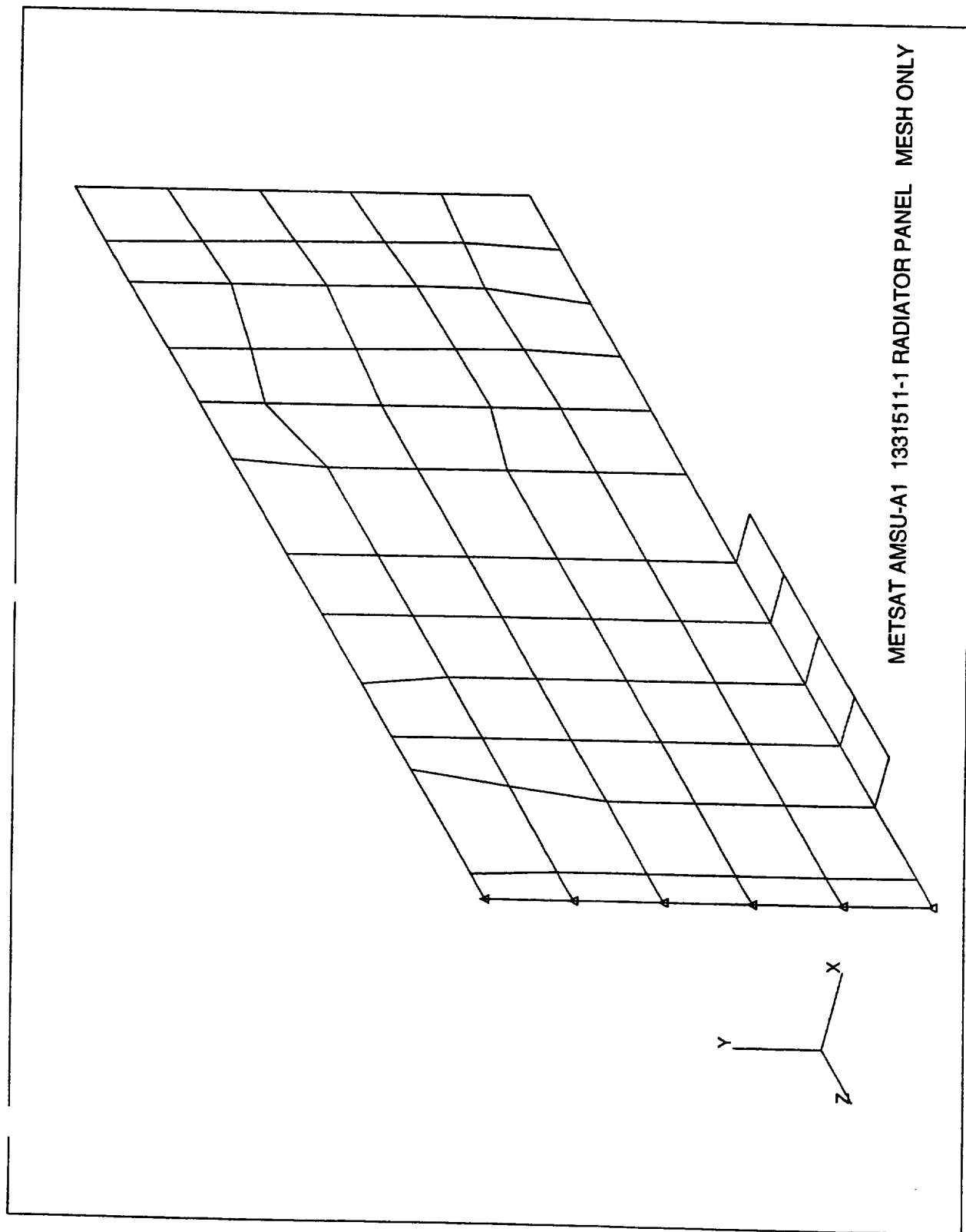


Figure A-120 METSAT AMSU-A1 1331511-1 Radiator Panel Mesh Only

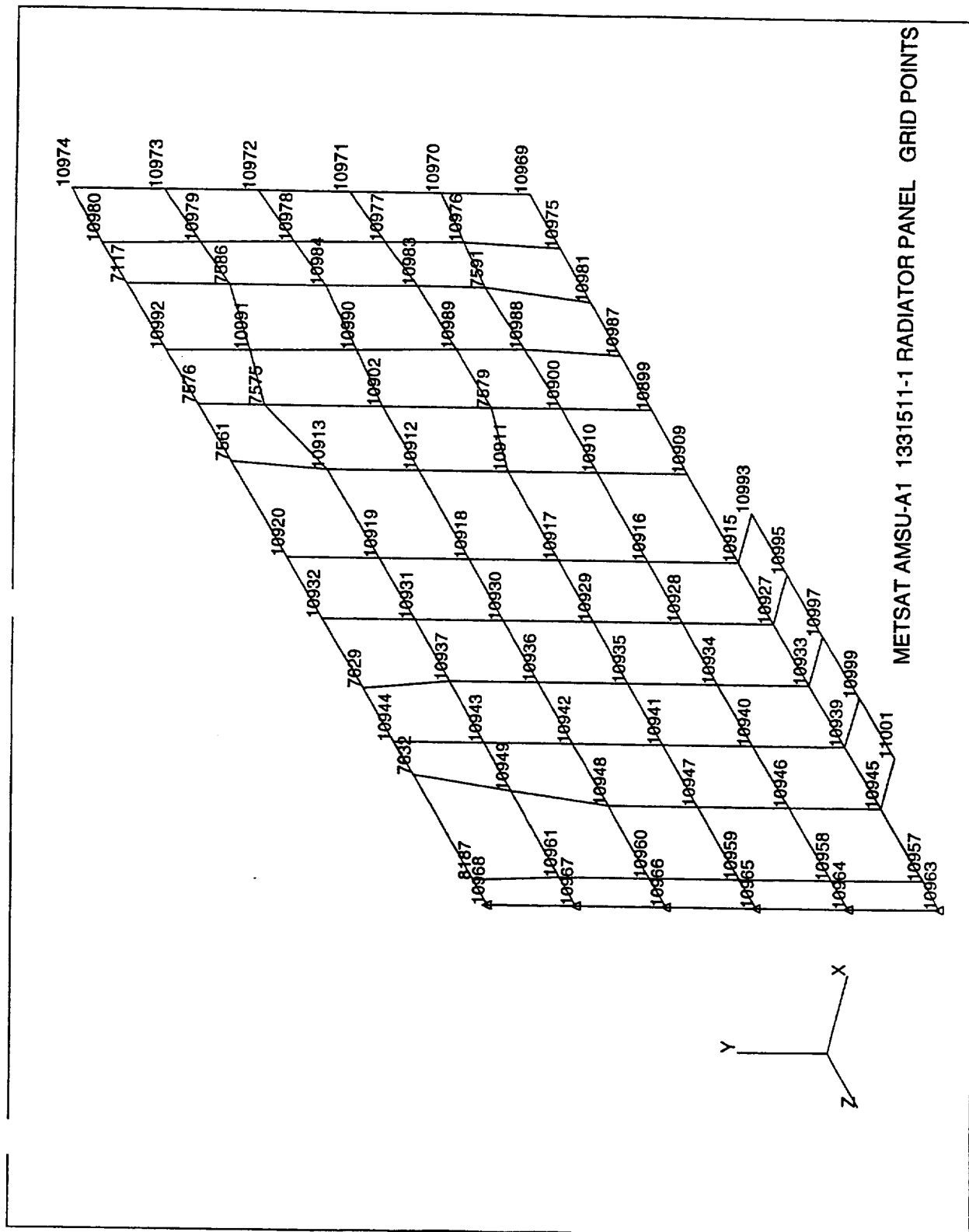


Figure A-121 METSAT AMSU-A1 1331511-1 Radiator Panel Grid Points

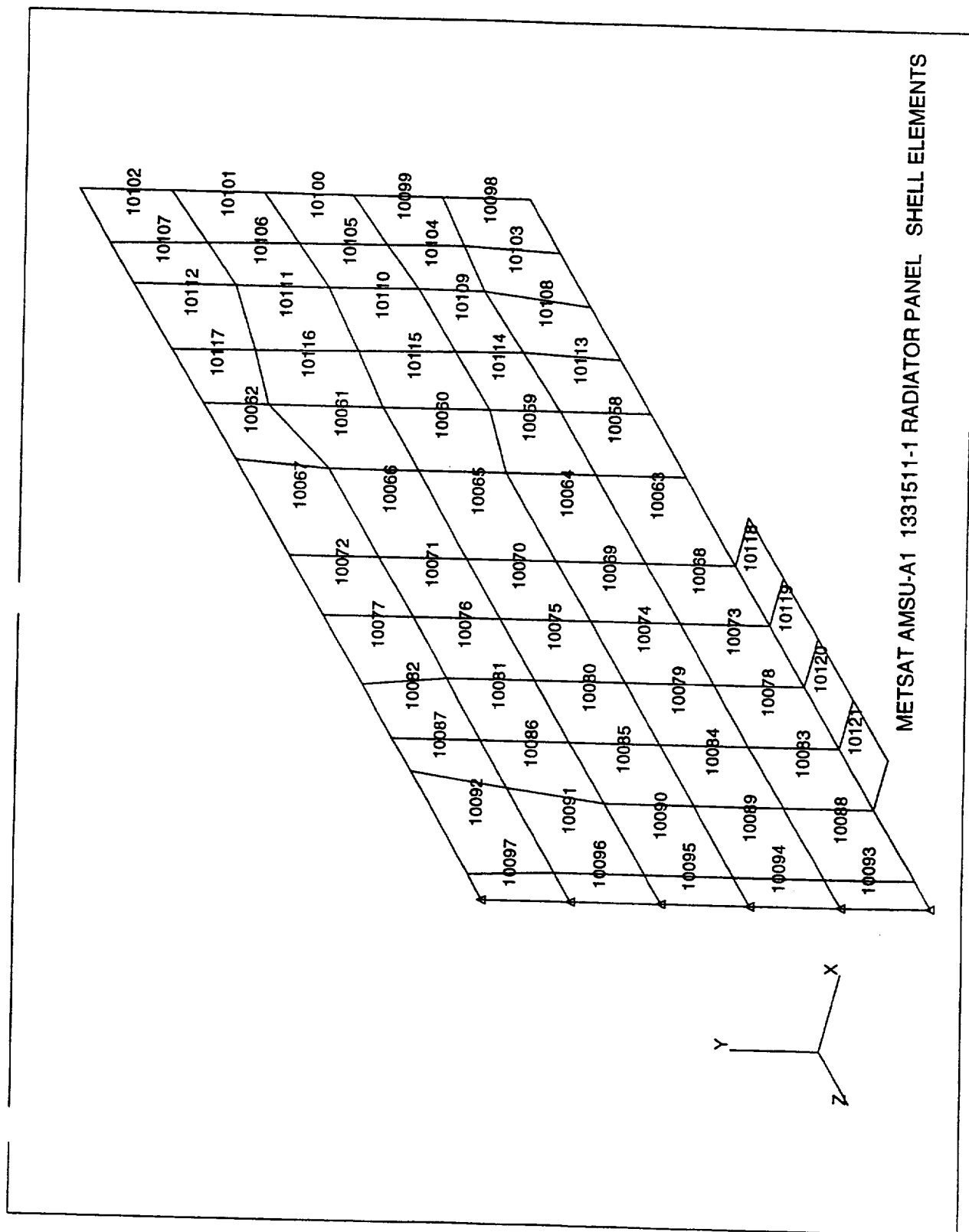


Figure A-122 METSAT AMSU-A1 1331511-1 Radiator Panel Shell Elements

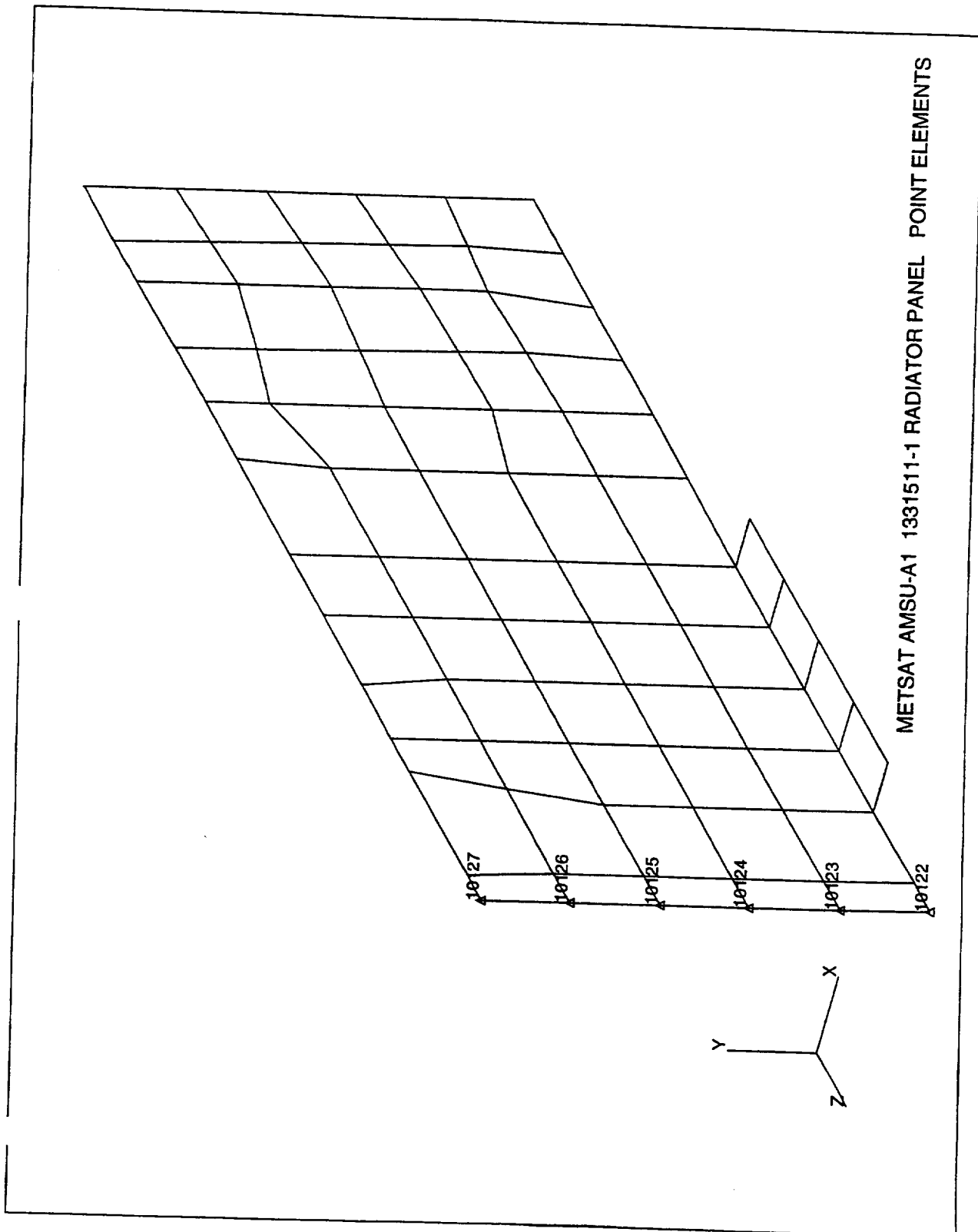


Figure A-123 METSAT AMSU-A1 1331511-1 Radiator Panel Point Elements

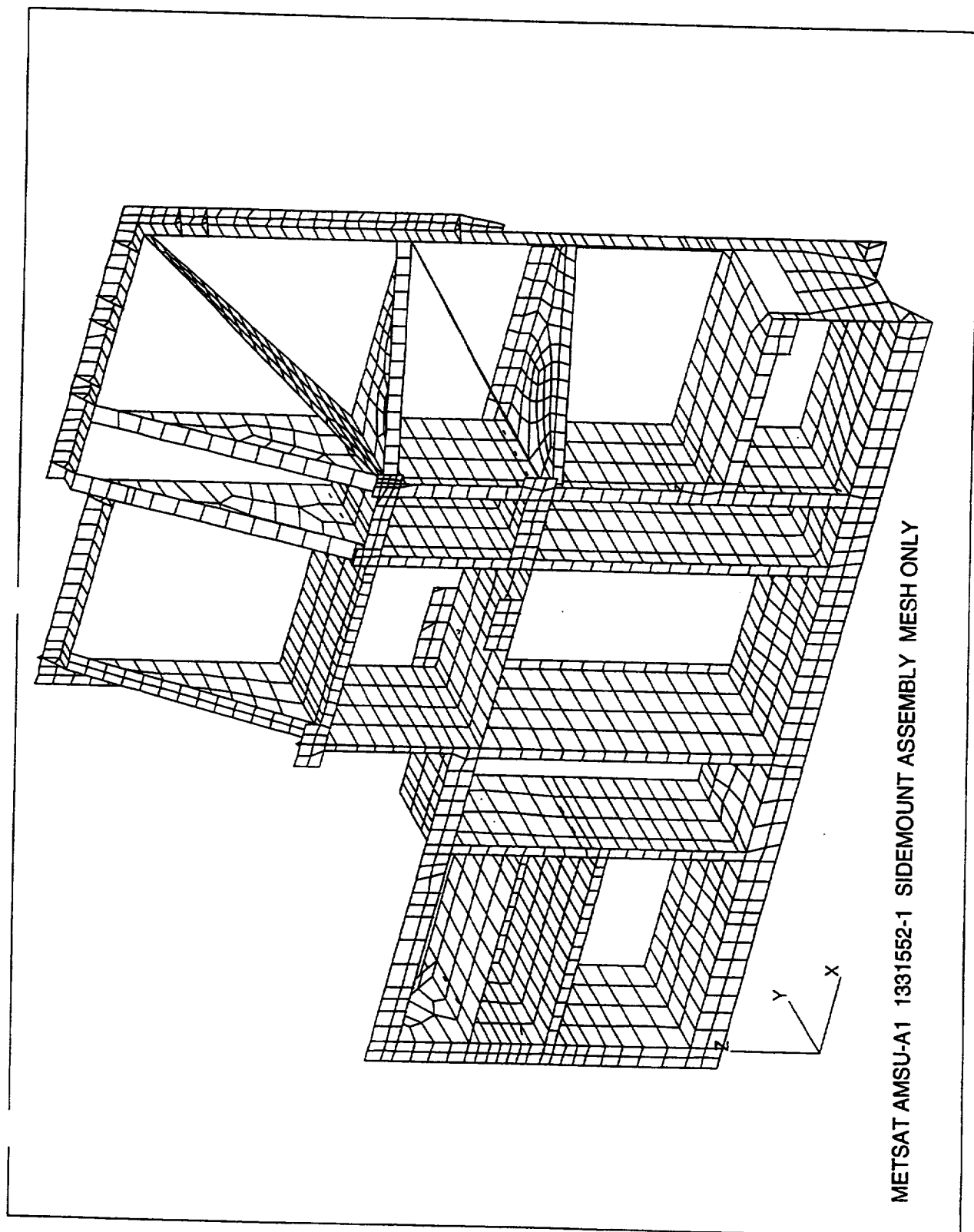


Figure A-124 METSAT AMSU-A1 1331552-1 Sidemount Assembly Mesh Only

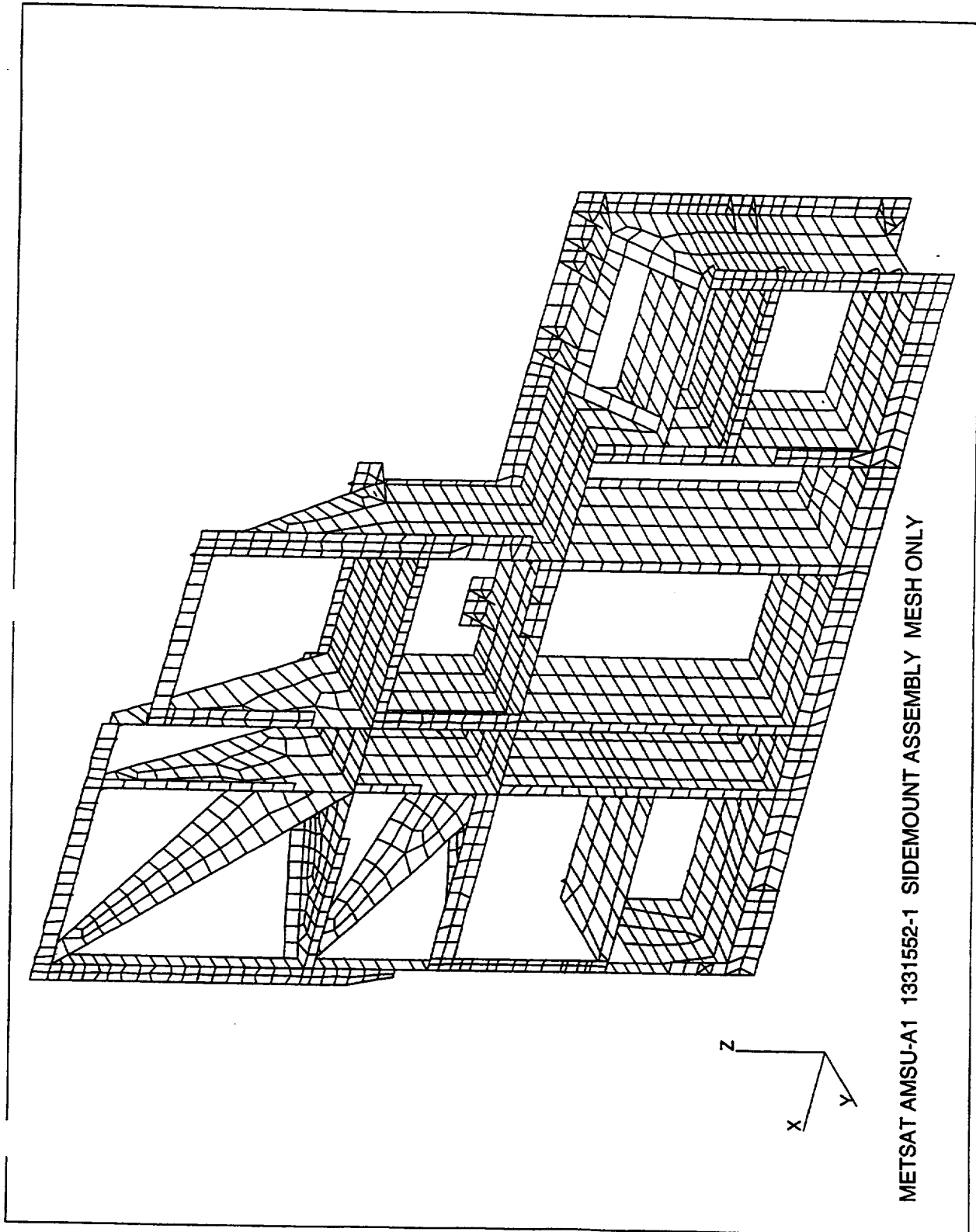
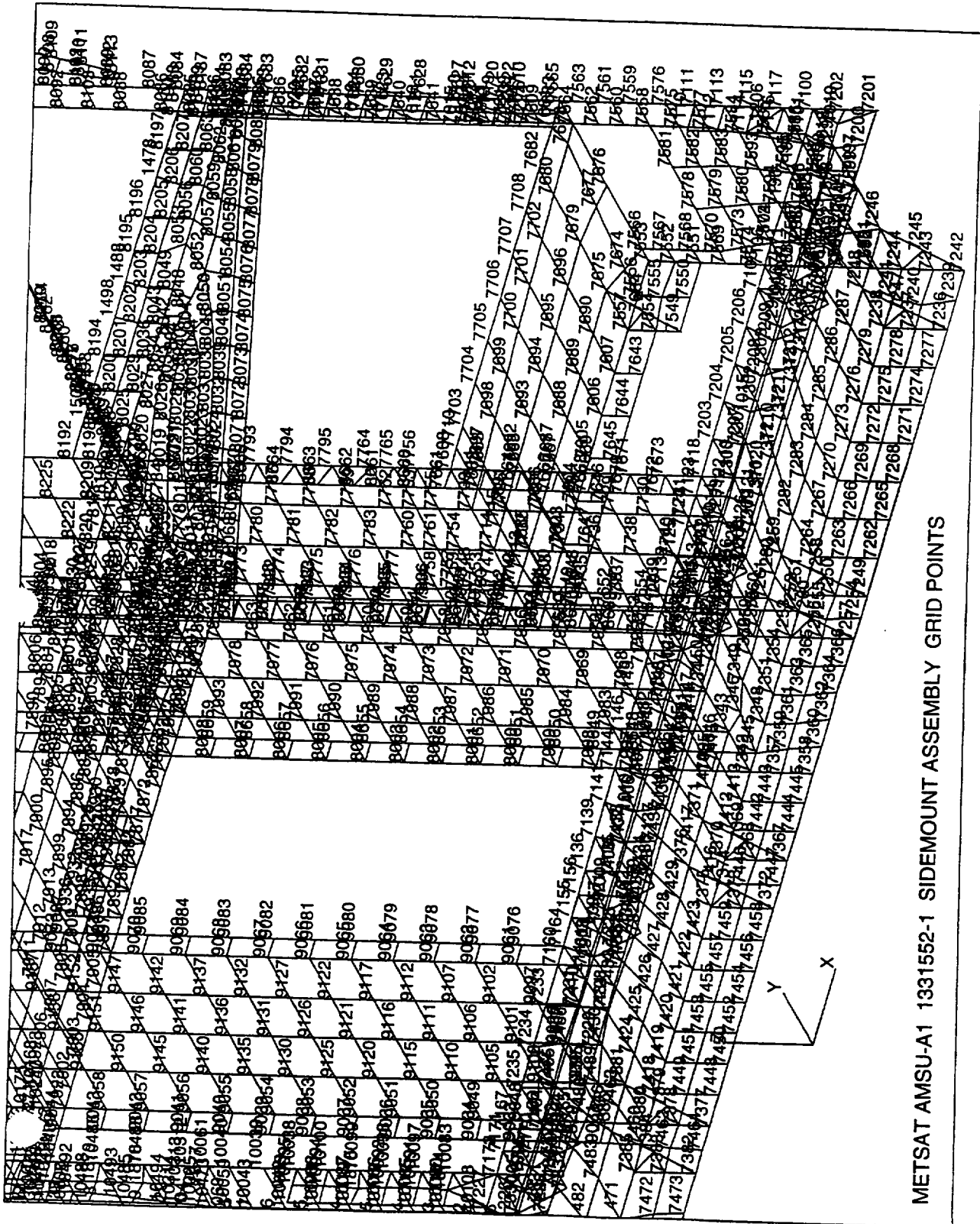


Figure A-125 METSAT AMSU-A1 1331552-1 Sidemount Assembly Mesh Only

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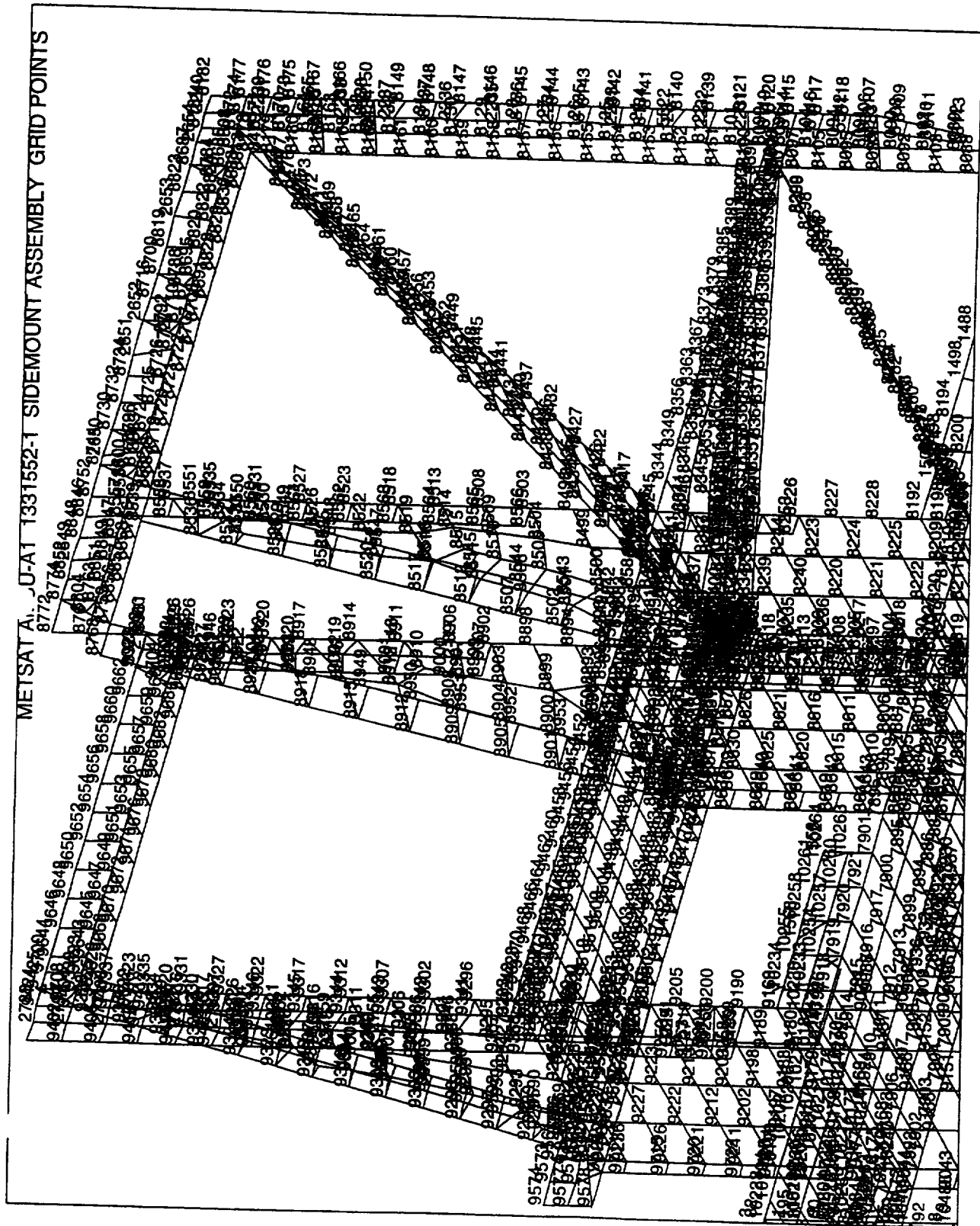


Figure A-128 METSAT AMSU-A1 1331552-1 Sidemount Assembly Grid Points

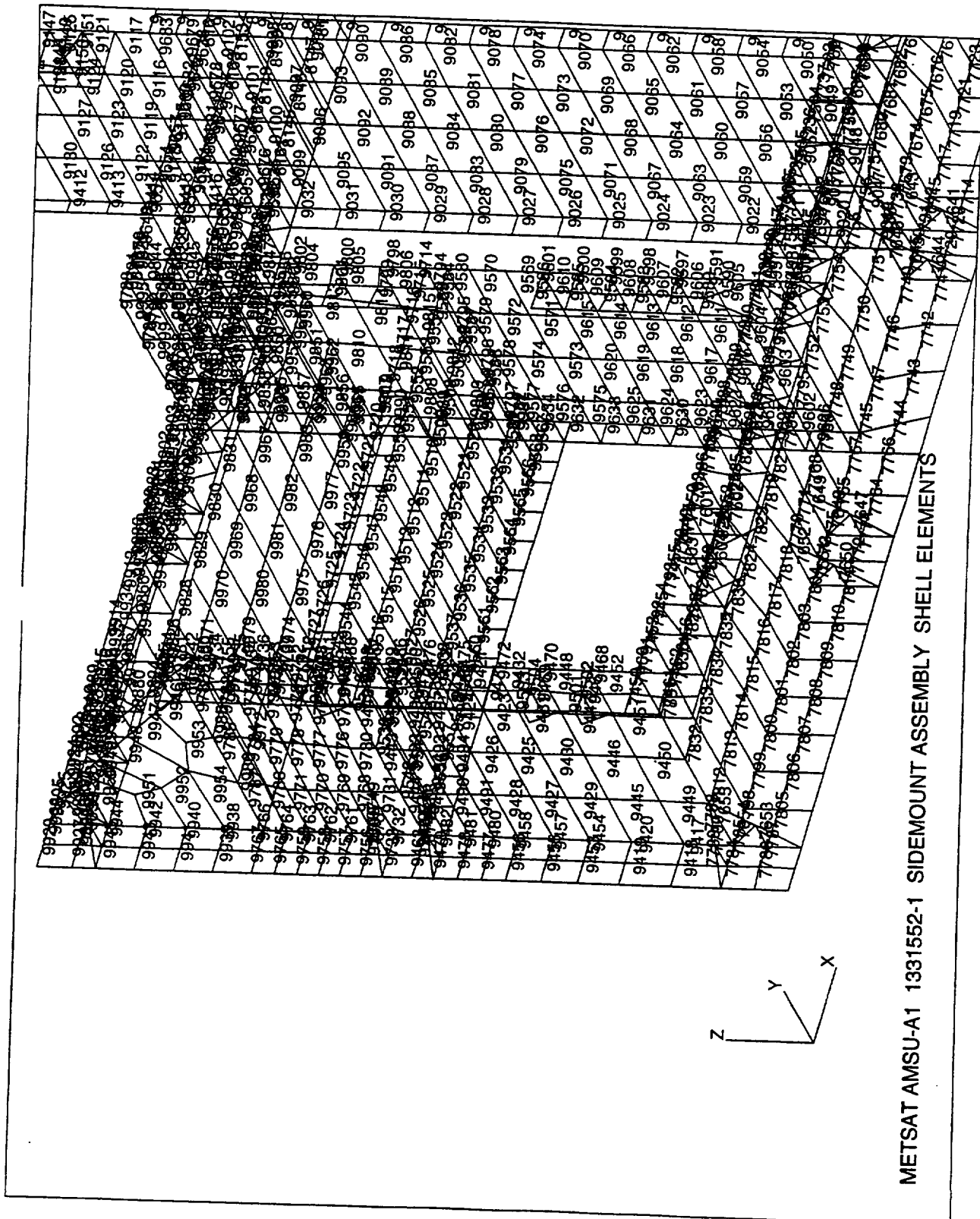


Figure A-129 METSAT AMSU-A1 1331552-1 Sidemount Assembly Shell Elements

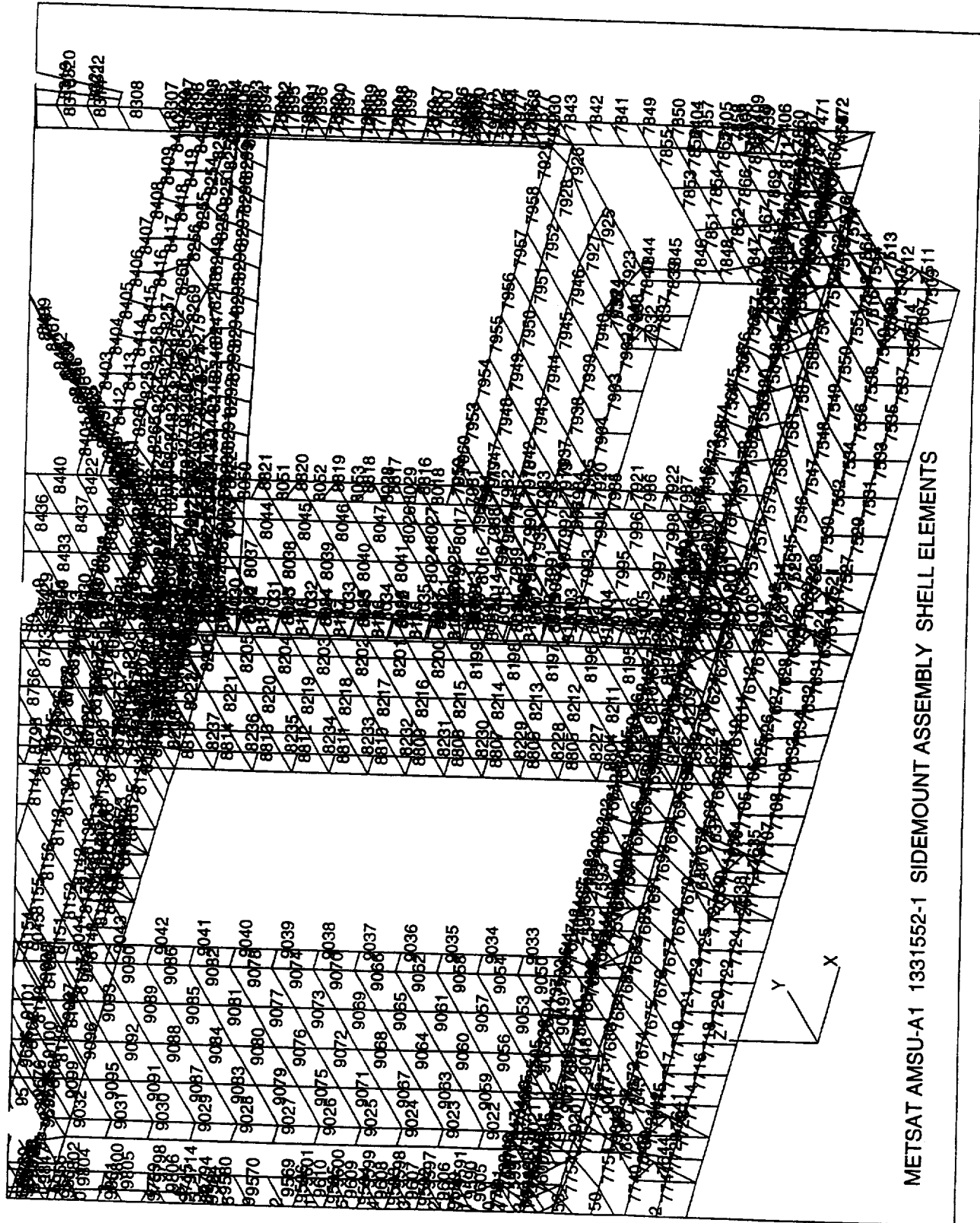


Figure A-130 METSAT AMSU-A1 1331552-1 Sidemount Assembly Shell Elements

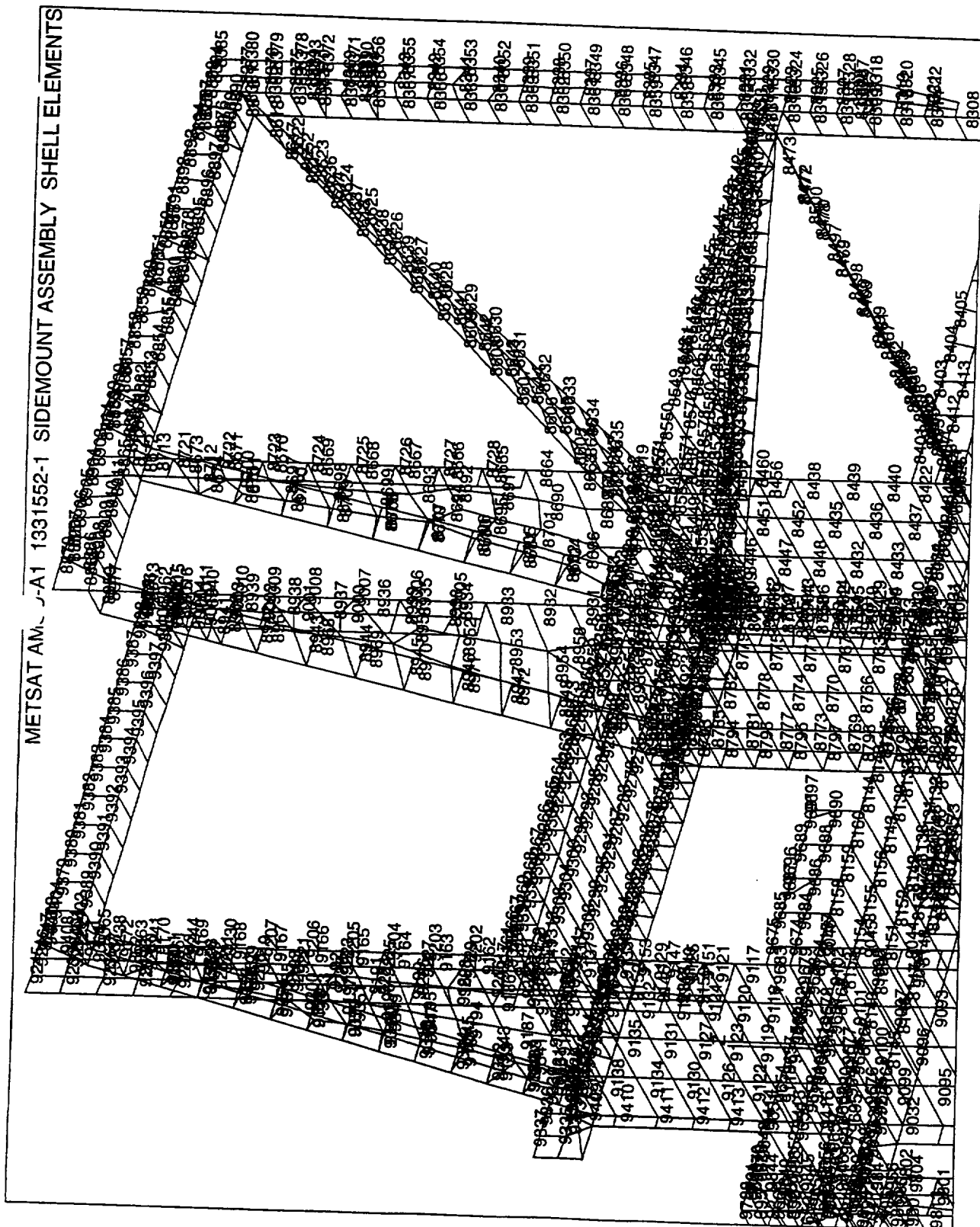


Figure A-131 METSAT AMSU-A1 1331552-1 Sidemount Assembly Shell Elements

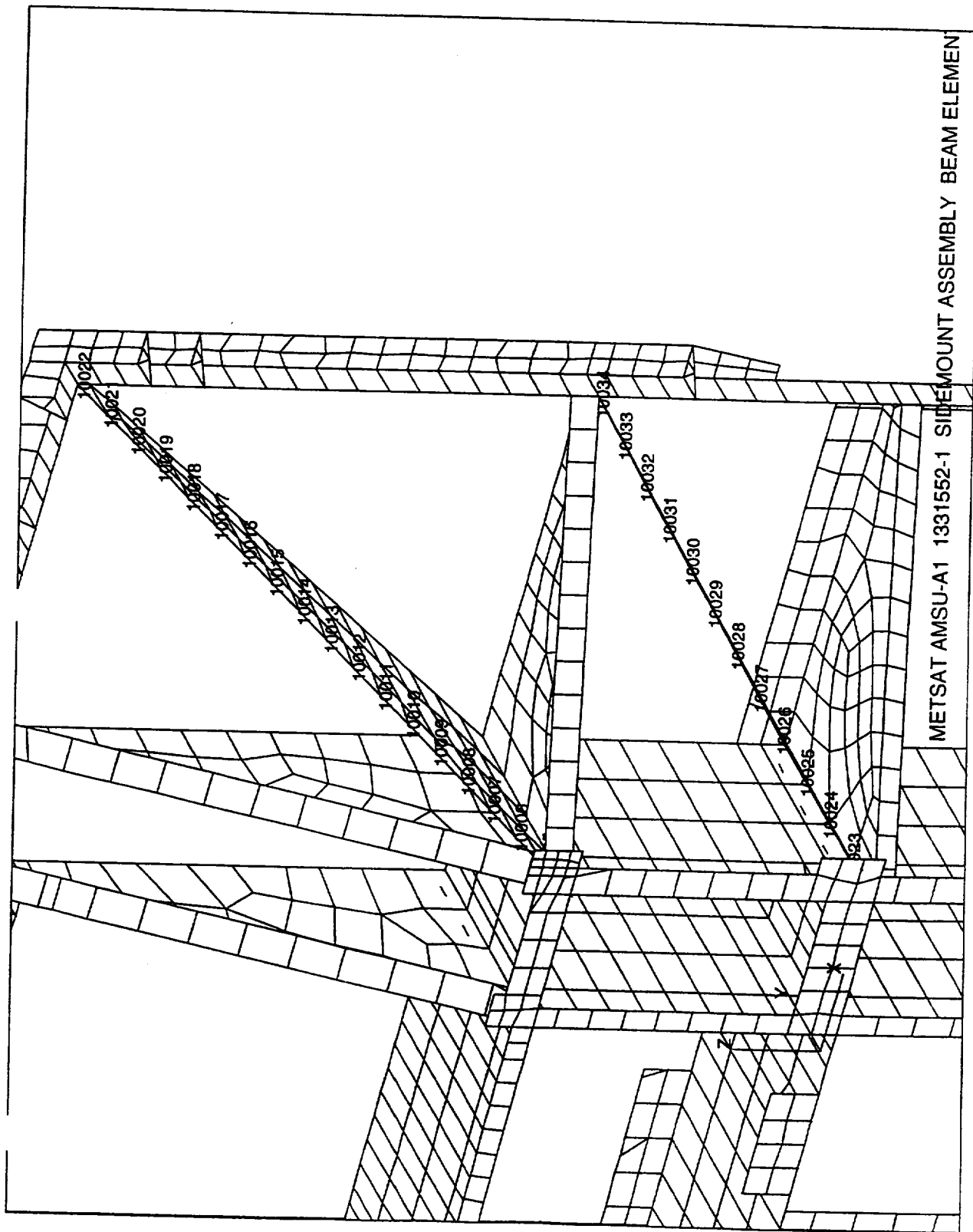


Figure A-132 METSAT AMSU-A1 1331552-1 Sidemount Assembly Beam Element

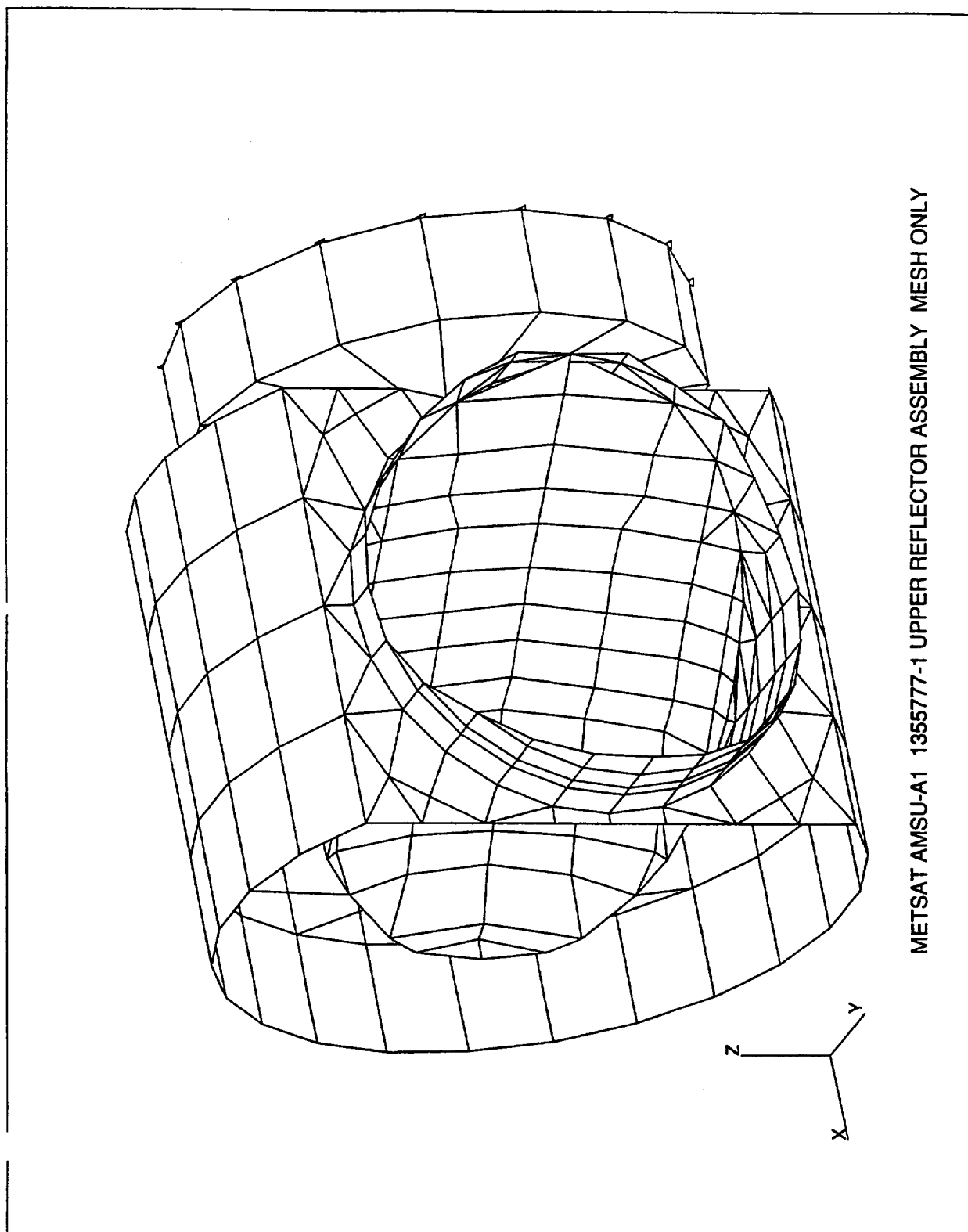


Figure A-133 METSAT AMSU-A1 1355777-1 Upper Reflector Assembly Grid Points

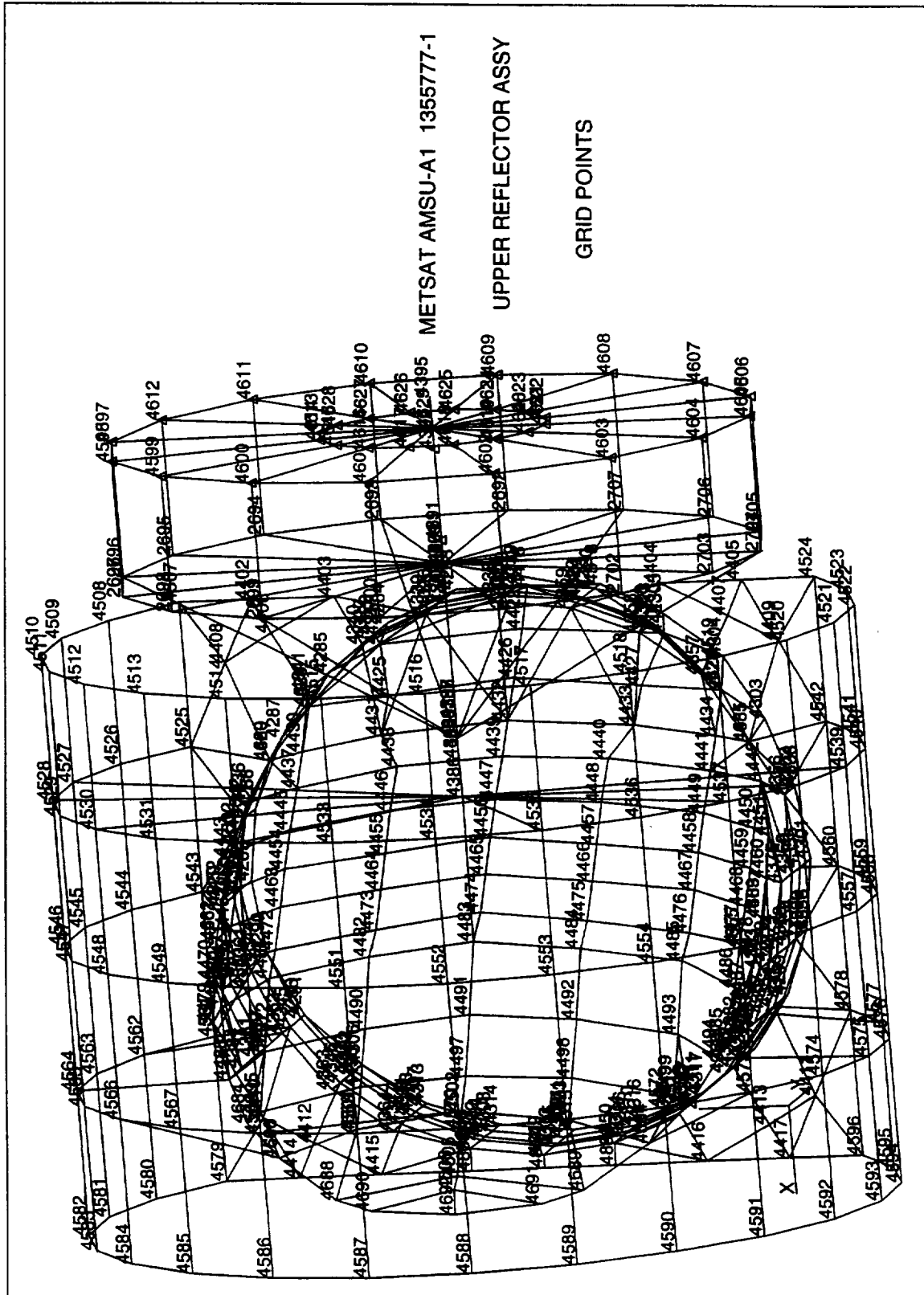


Figure A-134 METSAT AMSU-A1 1355777-1 Upper Reflector Assembly Grid Points

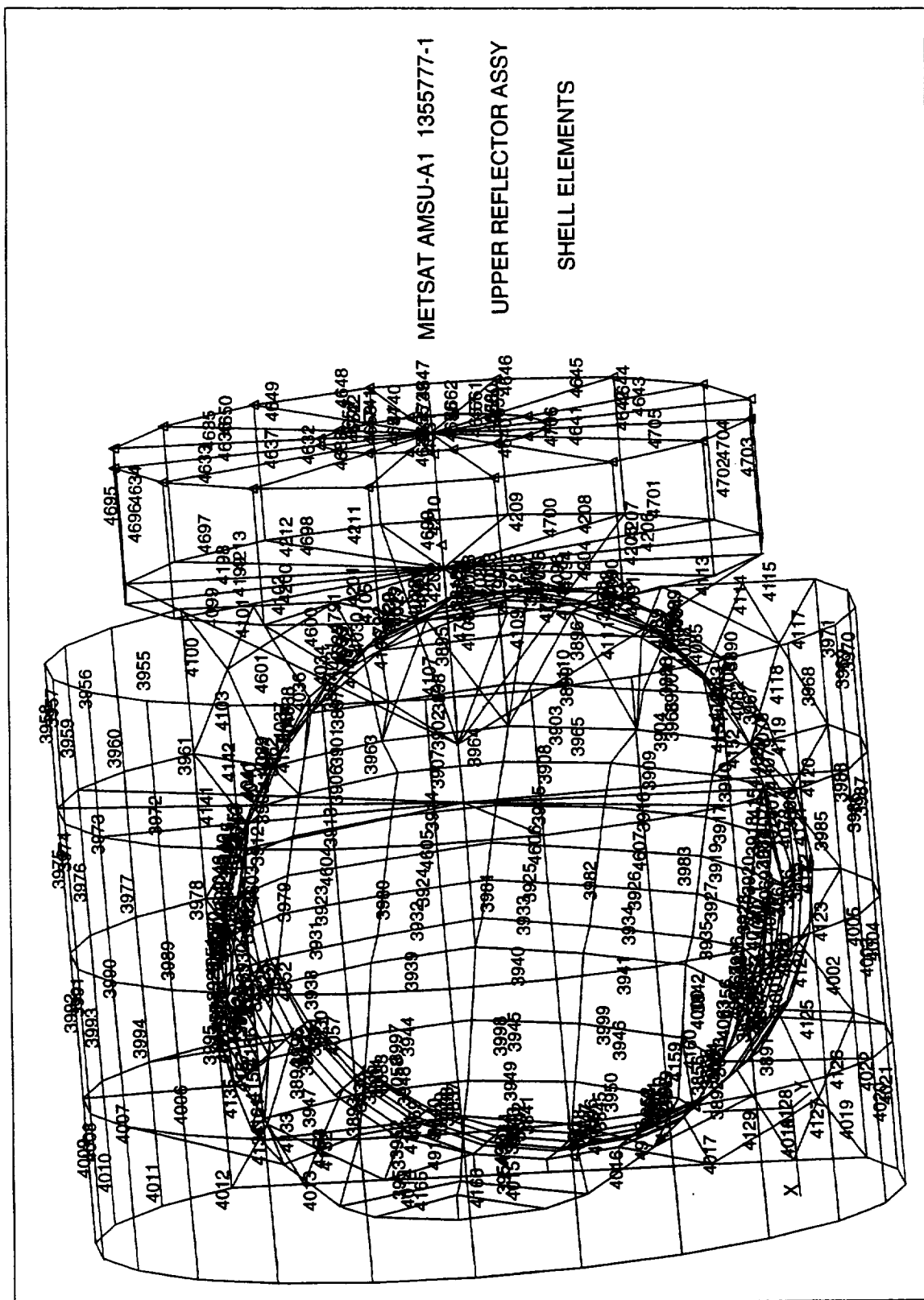


Figure A-135 METSAT AMSU-A1 1355777-1 Upper Reflector Assembly Shell Elements

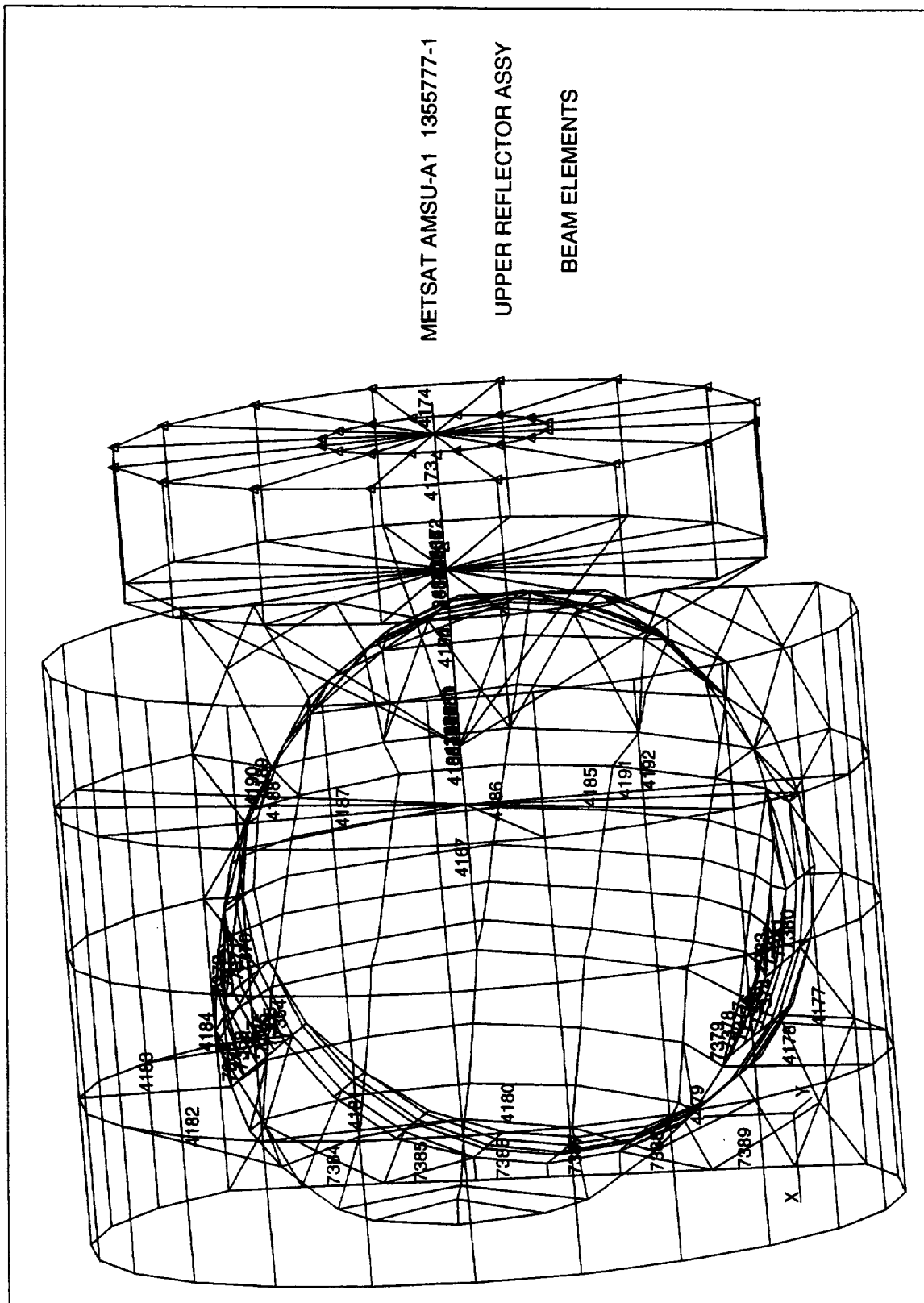


Figure A-136 METSAT AMSU-A1 1355777-1 Upper Reflector Assembly Beam Elements

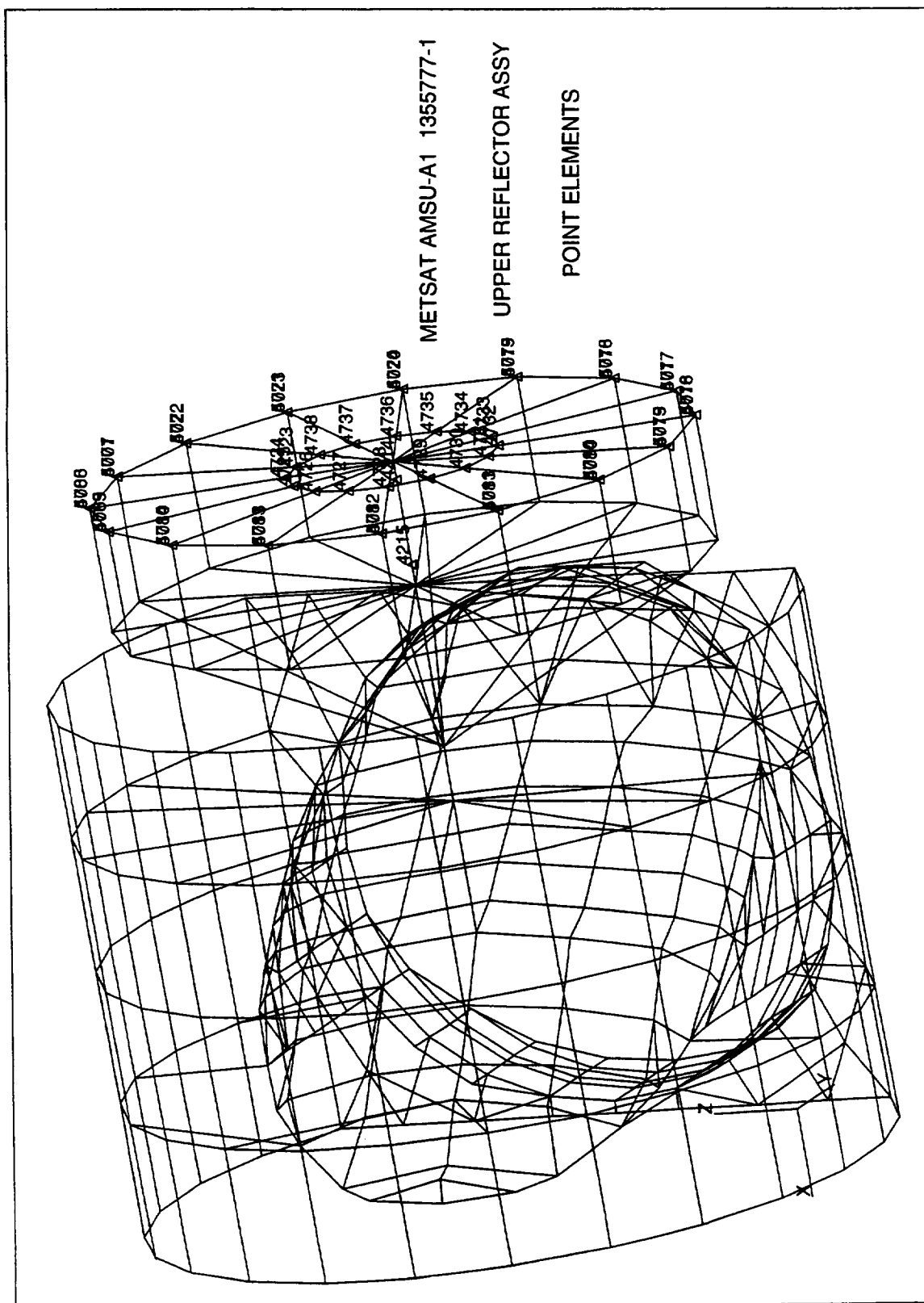


Figure A-137 METSAT AMSU-A1 1355777-1 Upper Reflector Assembly Point Elements



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